SCIENTIFIC AMERICAN

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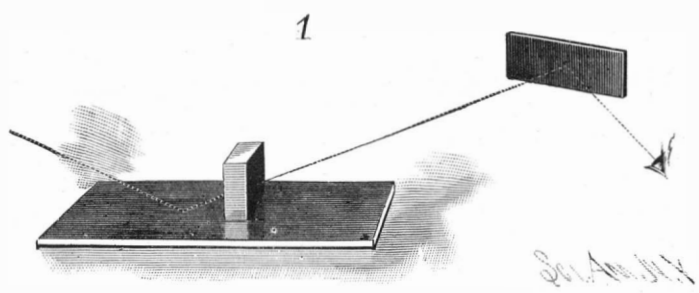
SIMPLE EXPERIMENTS IN POLARIZED LIGHT.

BY GEO. M. HOPKINS.

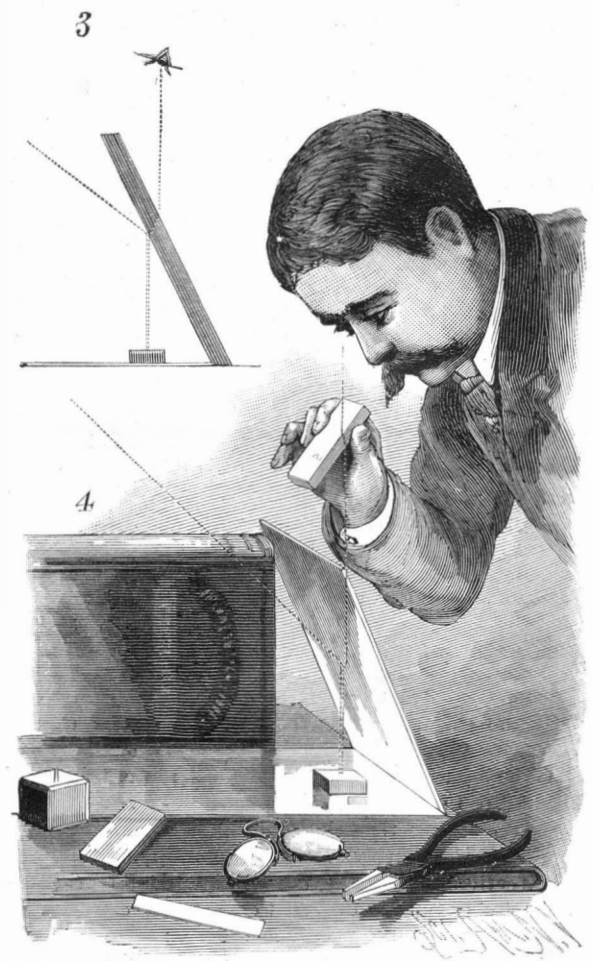
I.

It is ever a source of pleasure to the student of science to be able to explore an unfamiliar realm by means of commonplace and readily accessible things, which, if not already possessed, may be had almost for the asking.

There is scarcely a branch of scientific research more prolific in the development of expensive apparatus than that of light, yet there is nothing in the domain of physics capable of being better illustrated by apparatus of the most simple and inexpensive character. The subject of polarized light, as intricate and difficult as it may at first appear, may be illustrated by apparatus costing less than a dime, in a manner that can but excite the wonder and admiration of one inexperienced in this direction.



POLARIZATION BY REFLECTION FROM BLACKENED GLASS.



SIMPLE FORM OF NORREMBERG DOUBLER.

A small piece of window glass and a black covered book constitute the apparatus for beginning the study of this interesting subject, and with a glass bottle stopper, a glass paper weight, or a piece of mica, the effects of polarized light may at once be shown.

The book is placed horizontally near a source of light, such as a window or a lamp, so that a broad beam of light will fall obliquely on it, and upon the book is placed the object to be examined, which may be either of those named.

Now, by viewing the reflected image of the object in the piece of window glass, with the glass arranged at the proper angle, it is probable that colors will be seen in the object. If no colors appear, it is due to one of three causes: either the object is incapable of depolarizing the light polarized by reflection from the book cover, or it is too thick or too thin to produce interference phenomena, or the eye of the observer and the glass employed for the analyzer are not in a correct position relative to the object and the polarizer (the book cover).

The glass, if thoroughly annealed, will produce no effect on the polarized beam, but most thick pieces of glass, such as paper weights, ink stands, heavy glass bottle stoppers, and the like, are either unannealed or only partly annealed, and are thus under permanent strain, which is readily indicated by their action on polarized light. A plate of mica of suitable thickness exhibits bright colors when examined by polarized light, particularly when the plate is either bowed or inclined.

To render the polariscope thus described more efficient, a plate of glass may be placed on the book, when the superior reflecting surface will at once make itself manifest in the increased brightness of the colors and improved definition of the object. A still greater improvement may be made by blacking one side of each glass with asphaltum varnish or any other convenient black varnish or paint, using in the experiments the unblackened surfaces, as shown in Fig. 1.

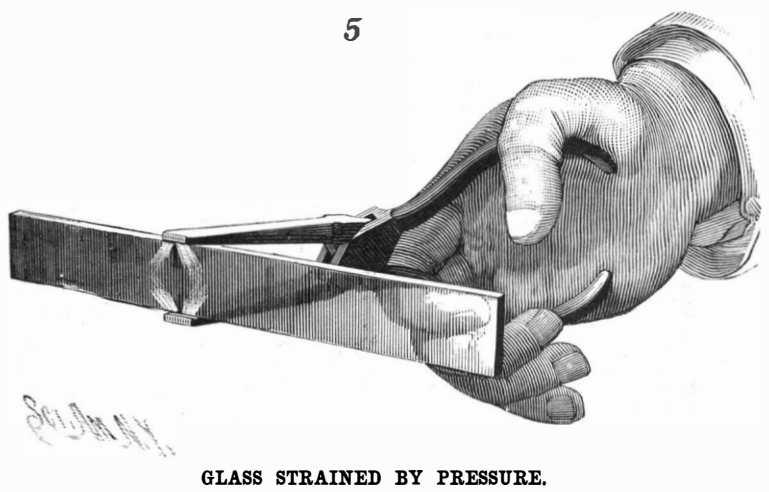
The angle which the incident light beam should make with the polarizer or horizontal blackened plate is 35° 25′, and the polarized beam should strike the analyzing plate at the same angle, to secure the maximum effects; but it is unnecessary to measure the angles, as they may be easily determined by the appearance of the object.

With the two plates of blackened glass much may be learned with regard to the properties of polarized light. Plates of mica of various thicknesses and forms, inclined at various angles, bowed and turned in their own planes, pieces of quartz, bodies of glass such as those already mentioned, and odd-shaped pieces of unannealed glass such as may be picked up at glass works, are easily secured objects. Brazilian pebble spectacle lenses often show gorgeous colors when turned at different angles in the beam of polarized light.

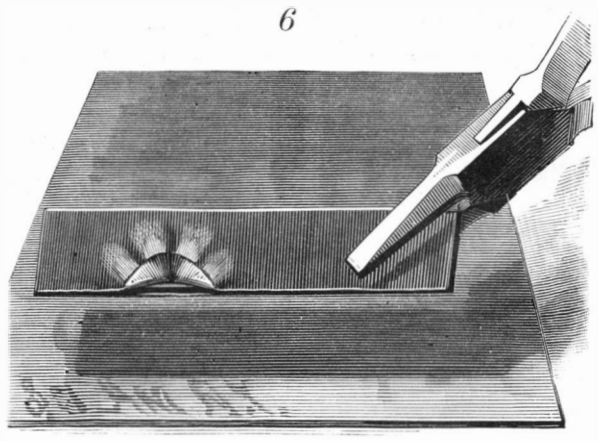
The writer well remembers the smiles provoked among the storekeepers when he visited various stationery and fancy goods establishments, armed with a Nicol prism, in quest of objects for the polariscope. As one article after another was placed upon a dark covered book, and examined with the prism, the writer imagined he could vaguely hear such words as Ward's Island, asylum, etc., and at this stage, as a matter of policy, the purchases were generally made, for sanity was at once established when the dealer examined the articles for himself with the Nicol, and the price of certain glass objects immediately advanced.

Seeing their own wares by polarized light, for some of the dealers, at least, was a new experience.

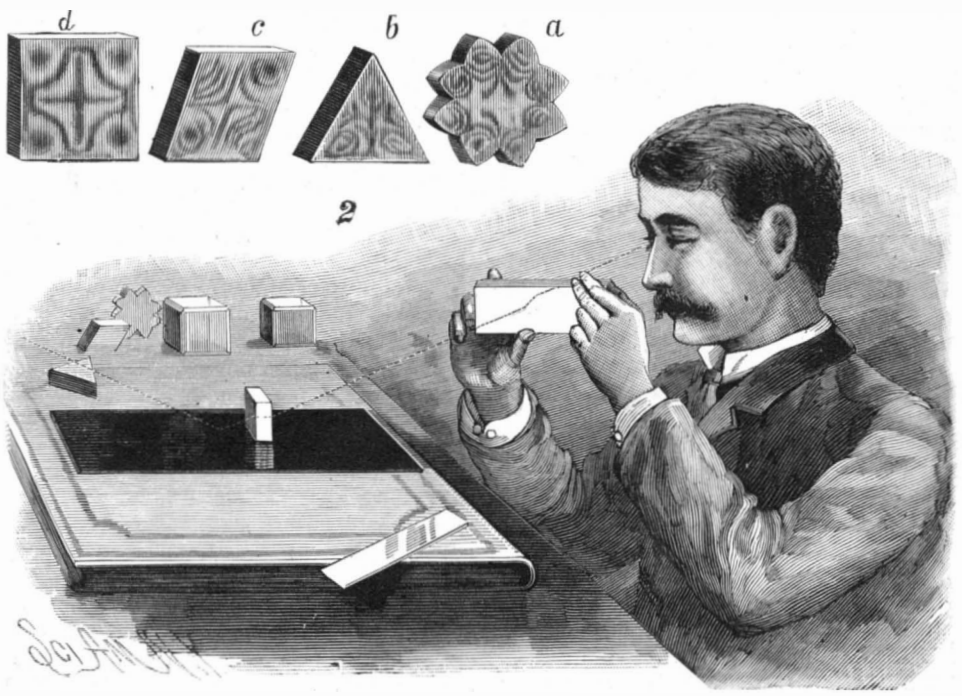
The best position for the polarizing plate is near a window, with the broad light of the clear sky shining upon it.



GLASS STRAINED BY PRESSURE.



GLASS STRAINED BY HEAT.



ANALYZATION BY BUNDLE OF GLASS PLATES AND VERRE TREMPE.

By turning the analyzing plate on the axis of the light beam, some curious effects may be observed. When the plates are at right angles with each other, the polarized beam will be nearly quenched,* and when they are parallel with each other the reflection of the sky will be quite bright.

The employment of a blackened glass reflector for an analyzer is attended with some difficulty, on account of the necessity of changing the position of the eye for each new position of the analyzer. A bundle of six or eight plates of ordinary glass is more convenient, but not quite as efficient. These plates will be used as shown in Fig. 2, the light passing through them to the eye instead of being reflected. The plates may be turned at any angle without changing the position of the eye.

(*Continued on page 6.*)

* With black glass reflectors employed as polarizer and analyzer, the extinction of the light is not quite complete, even when they are arranged accurately at the polarizing angle. See paper on "Polarized Light" in SUPPLEMENT 538.

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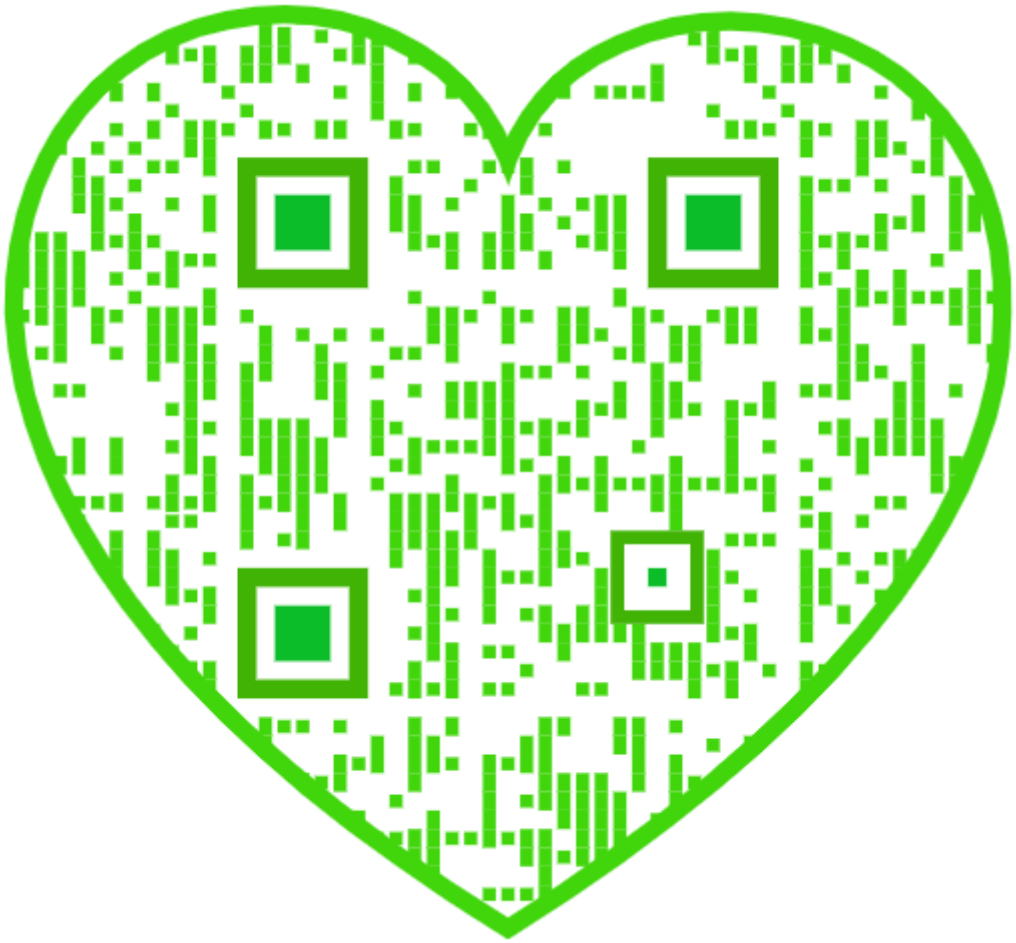

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NEW YORK, SATURDAY, JULY 3, 1886.

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THE ILLUMINATING GAS INDUSTRY.

To one who has been familiar with the gas industry of this country for the last twelve years, the changes which have taken place in it are very remarkable. They have affected not only the manufacturing processes, but the business standing. While the technical part has advanced, the business has changed from one of the most conservative industries to one of competition. Twelve years ago, almost all the gas used in the world was made from bituminous coal. From 9,300 to 9,600 cubic feet per ton of 2,240 pounds was considered good practice. From retorts about twenty inches in width, a daily yield varying from 5,500 to 6,000 feet was looked for. At about that period, naphtha gas began to occupy some attention, and a series of many experiments was inaugurated, and even to-day that series continues. Every few months the subject would come up, and the proposal to put in naphtha works would be received by the companies. As a rule, gas engineers were violently opposed to any departure from the old process with which they had so long a familiarity, and any attempts to introduce naphtha gas were resisted by them most strongly.

In New York city a break was made by the Municiple Gas Co. Under Tessie du Motay's process they began making water gas carbureted with naphtha. After many and very expensive experiments, processes, and failures, they began to supply a large number of consumers, and naphtha gas in New York was a fixed fact. The Mutual and Metropolitan companies also began to use the same substance, and naphtha was consumed in enormous quantities. The old New York Gas Light Co. adopted the Tessie du Motay process, and while allowing their coal gas furnaces to stand, abandoned their use. This company was always considered one of the most conservative, and their adoption of the new process told much in its favor.

Two things have made water gas a success in this country. One is the cheapness of naphtha. Owing to the immense development of the petroleum industry, naphtha was becoming a drug on the market, and the oil companies are glad to dispose of it at a nominal price. The other factor is anthracite coal. This fuel is peculiarly suited for the water gas process. Other coals can be used, but cheap naphtha is almost a *sine qua non*. Everything depends on a supply at low prices. A rise of three or four cents per gallon would be a very serious matter. But for the present, naphtha, it may be assumed, is not about to double in price.

Coal gas engineers were stirred up by this rivalry, and tried to improve their process. Retorts of larger size were used, sometimes as much as 36 inches wide. For many years the idea had prevailed that coal should be distilled at a low red heat. This theory was abandoned, and every effort was made to get as high a heat as possible consistent with the preservation of the retorts. New furnaces were invented, of the regenerative or gas burning type. Siemens' furnace was used extensively on the continent of Europe, but in this country simpler modifications of it were more popular. By these means the yield of gas per ton of coal was brought up to 12,000 cubic feet, and the yield per retort was doubled. This indicates a remarkable revolution, due to the inventors' work of the past fifteen years. To realize what the work has been, the *Patent Office Gazette* should be consulted, and the number of patents in gas should be noted. The number is very great, the class is one of the most important and largest, and the work is still in progress. The lesson incidentally disclosed is of practical interest. By the labor of patentees, the production of gas at a low price has been made possible, and the consumers of New York alone are saved five millions of dollars per annum. It is a good illustration of the policy of protecting inventors.

This competition with water gas has permanently cheapened coal gas, and the reduction in cost has been favored by the low price of coal. Naphtha is still supplied in limitless quantities, while natural gas has usurped the field throughout the oil regions. How long the petroleum gas industries will last is uncertain. Professor Leslie has announced his belief that sooner or later the decline will come. It is hard to believe that gas can continue to pour out of the earth at many atmospheres of pressure for all time. But the work has been done, gas has been cheapened, and will never again cost as much to make as it has in the past. Even if petroleum should become scarce, the coal gas works are in better condition than ever, owing to the stimulus of competition and invention.

In this city, after a fierce struggle for supremacy, the principal companies formed a pool, and so raised the price of gas. The next move was a permanent consolidation, which brought together five of the old competitors. But as opposition still existed, the price was kept reasonably low. Within a few weeks, the legislature reduced the price still lower. A few days ago a new company applied for a charter, with a still lower limit of price. On the 22d of the present month, the Attorney-General is to consider the propriety of instituting proceedings for the annulment of the consolidation. The legislative lowering of price means a reduction in receipts for this city of nearly three millions of dollars per annum.

The contrast between the present time and a period ten or twelve years back is very great. Then, each company in New York had its own district, with only one general competitor. All through the country each company possessed a substantial monopoly. Now, the struggle so familiar here extends everywhere. The smaller cities have opposition companies, and both coal gas and water gas are made in many of them.

It seems at present as if enough had been done by the legislature. It has forced gas down to a barely remunerative price. It is now sold at a rate at which none can complain. If the breaking up of the consolidated company is executed, it is doubtful if any change in price will be brought about. The experience of pooling that extended over several years showed the efficacy of such a method of dealing with the subject, and, in the event of the disbanding of the consolidated gas company, would probably be again resorted to.

PHOTOGRAPHIC NOTES.

Potash and Soda Developers.—Before the Society of Amateur Photographers in this city, Mr. H. J. Newton stated that the following formula had yielded him excellent negatives. Each solid ounce contains 480 grains:

No. 1.

Water	32 ozs.
Carbonate of soda (crystals)	3 "
Carbonate of potash	3 "

No. 2.

Water	32 ozs.
Sulphite of soda (crystals)	3 "

One ounce of developer is prepared as follows:

No. 1	1 drachm.
No. 2	7 drachms.
Dry pyrogallic acid	2½ grains.

In case a dozen 6½×8½ plates are to be developed, 10 ounces of the developer can be mixed at a time, which will keep good for a day or two. One plate after the other can then be developed with great uniformity in the same solution. If a plate is underexposed, from 3 to 6 drachms of No. 1 should be added. More intensity is gained by the addition of pyro. Overexposure is remedied by the use of a very small quantity of No. 1.

Ripley's Soda Developer.—A formula which produces clear, brilliant negatives has recently been devised by Mr. Geo. H. Ripley, of Brooklyn, N. Y., also a member of the N. Y. Amateur Photographer's Society, and is prepared as follows:

No. 1.

Water (distilled)	20 fl. ozs.
Sulphite of soda (crystals)	5 ozs.

Dissolve, filter, and add slowly enough sulphuric or nitric acid to make solution slightly acid. Test with blue litmus paper.

Pyrogallic acid	1 oz.
Distilled water, to make the whole measure	30 fl. ozs.

No. 2.

Water	20 fl. ozs.
Carbonate of soda (crystals)	2 ozs.
Water, to make the whole measure	30 fl. ozs.

Weights given are based upon 480 grains to the ounce.

To develop a normally exposed 5×8 plate, take 1 oz. each of No. 1 and No. 2. The developer has the property of remaining remarkably clear, and may be used repeatedly, if properly stored in a stoppered bottle. The directions concerning the manipulation of the developer for obtaining different effects and counterbalancing errors in exposure are as follows:

If the plate is *underexposed*, or should show too great contrasts, transfer, *without washing*, to another tray containing solution No. 2. When the detail is well started, return the plate to and finish in the mixed developer.

If the plate is found to be overexposed, add to the mixed developer a few drops of the following solution:

Water	1 oz.
Bromide of ammonium	50 grs.

To obtain soft effects, the quantity of No. 1 should be reduced. For use upon slower plates, such as are employed in the making of transparencies, a special solution is prepared as follows:

Sulphite of soda (crystals)	3 ozs.
Citric acid	60 grs.
Bromide of ammonium	30 grs.
Water	28½ ozs.

The developer is formed as follows:

No. 1	½ oz.
No. 2	½ oz.
Sulphite and citric acid solution	½ oz.

The Cause of Pneumonia.

Referring to our recent editorial on ozone and pneumonia, a subscriber suggests that one cause of the prevalence of the disease is to be found in the almost universal custom of keeping houses, stores, and factories at such a high temperature that the change experienced on passing to the cold atmosphere out doors is more severe than delicate persons can subject themselves to without danger. Overheating and the want of sufficient ventilation are undoubtedly responsible for much sickness.

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COMPRESSED AIR FOR LIFE BOATS.

To the Editor of the Scientific American:

In your paper of June 5, you print an article from the *Engineer*, on the means of forcing life boats out through the heavy surf and the rough water which are the necessary concomitants of the very circumstances which make their services of vital importance. The difficulties to be overcome are very forcibly and very correctly set forth, and the writer shows conclusively that the use of steam as a driving power for life boats is not within the range of possibility. The fire could not be maintained, nor could a boiler of any form, even if hung on gimbals, do its work. The violent shocks, to say nothing of the topsy-turvy commotions which the boat is constantly receiving, preclude absolutely the conjoint presence of steam and boiling water in the same reservoir.

If a life boat is to be forced out through the surf in any other way than by means of oars, it must clearly be by some power different from steam. And my present object is to show that such a power we have ready to our hand. It is now coming more and more into use, and for this special service is most admirably adapted; it is *compressed air*. Among several articles written for you by me in 1883, hoping to draw attention to the "Storage of Wind Power," was one, in your paper of Dec. 8, relating to its application to small motors. The facts, and the inferences from them, there stated bring us very appositely to the consideration of this matter of the life boats. The motor demanded must be: 1. Compact. 2. Unaffected by position or by shocks. 3. Always ready. 4. Able to supply the full power of a boat's crew and more, for often the strength of the crew is insufficient. 5. Sure in its action, and without risk of failure. 6. Involving as little weight as possible. Every one of these points is perfectly covered by the use of compressed air, as we shall see.

Nos. 1, 2, and 3 we need not consider, for they are manifest. Let us look to the requisite provision for No. 4. I propose to furnish the equivalent of twelve men, though no life boat carries such a crew on our coast. Such an amount of power, equal to two nominal horse power, will never be needed for any continued length of time. It is barely, in driving the boat out through the breakers, that it may be required, and for this a very few minutes must always suffice. After this, her crew are equal to her demand. And as the services of a life boat, in case of wreck, are limited to a brief period of time, we may safely calculate that the equivalent of one horse power for four hours is all that we need to provide and keep in store, and we can base our calculations on this amount.

Taking the ordinary tables, and assuming that the pressure on starting is 3,000 pounds, we find that reservoirs holding in the aggregate six square feet will give us all we need, with a surplus. After a service of four hours, we shall have in store a pressure of about 1,000 pounds. This is on the reckoning that we turn on as much as four horse power if required for sudden and brief strain. Thirty-one feet of six inch pipe will afford us the space indicated, and, if made of good steel, need not weigh over 300 pounds, say the weight of two men. But we have saved double that amount of load for the boat, for we have diminished the number of her crew. The services of the crew of a life boat are chiefly to manage the craft and take her to and from the wreck. Not more than two men commonly, and sometimes only one, can give their attention to the life saving work, all their skill and strength being otherwise demanded. And as we have the power for propulsion independently supplied, the boat need carry men only in proportion.

Another very important point is this: In shipping the terrible seas which so often come on board in the breakers, the men are caught by them at the greatest disadvantage possible. At the very moment when the crashing sea comes down on their heads and backs, each man's utmost strength must be given to his oar, and he is braced as solidly as the timbers of the boat, and receives the heavy blow without the slightest chance to shield himself. If, on the contrary, we are driving the boat as has been here proposed, the men can be shielded very greatly, and many bad injuries avoided.

As to the mode of applying the power secured in the use of compressed air, opinions may be various, as was clearly shown in the article mentioned, where some of the difficulties are well stated. But with the power supplied we certainly can find the means of using it. My own preference is decidedly for the method recommended by me in your paper of Jan. 5, 1884, that is, direct pneumatic propulsion. It needs perhaps a large amount of experimental work, but I fully believe that for such service as this of the life boat it affords the most efficient and most economical method available.

Of the method of compressing the air and holding it ready for instant service, I say nothing here. In the articles to which reference has been made, I expressed my ideas in brief on that point. A.

Iron Dissolved by Sugar.

MM. Klein and A. Berg have been studying the action of sugars on the corrosion of boilers, and find that sugar in water has an acid reaction on iron, which dissolves it, with a disengagement of hydrogen. The quantity of iron dissolved increases with the proportion of sugar in the water. The salt of iron formed is the acetate. A neutral decoction of malt also corrodes iron, with disengagement of hydrogen; but glycerine and mannite are without action on the metal. These results are worthy of note in sugar refineries and places where sugar sometimes finds its way into the boilers by means of the water supplied. The experimenters in question also find that zinc is strongly attacked by sugar; copper, tin, lead, and aluminum are not attacked.

THERE are reasons for believing, says the *Northwestern Lumberman*, that in the making of stock sizes of sash, doors, and blinds, in the factories of the Northwest, white pine will not much longer be the only material used. Poplar is commonly thought of as the most available substitute, and so it probably will be as long as it remains at anything like its present price, but there are other woods which may receive favor. One prominent Wisconsin manufacturer is now making doors of basswood, treating them to a priming coat of paint and sending them out to his regular customers. They are said to give good satisfaction in every respect, and particularly in point of price.

NIGHT SKY—JUNE AND JULY.

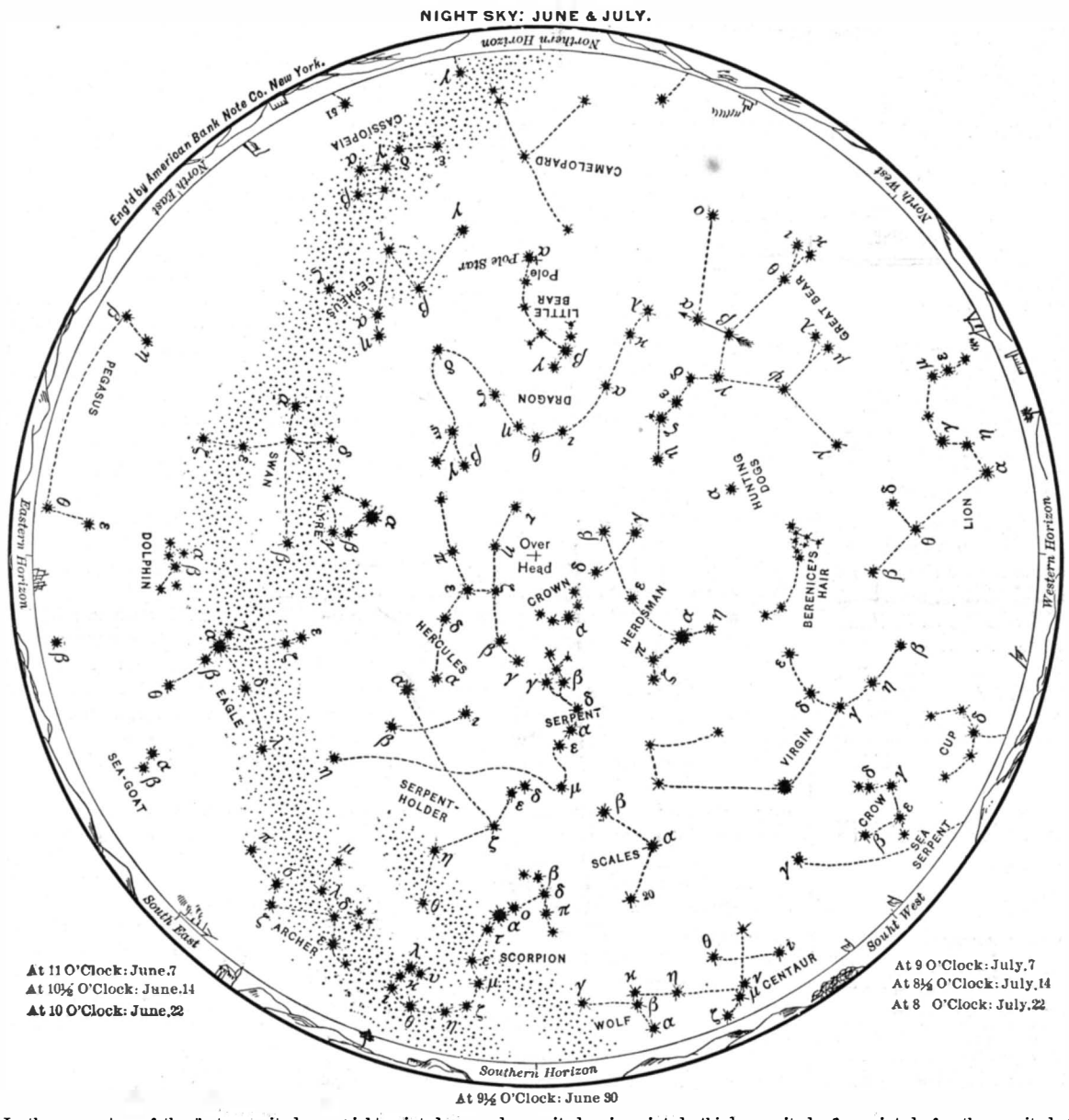
BY RICHARD A. PROCTOR.

The Great Bear (*Ursa Major*) is in the mid-heavens toward the northwest, the Pointers not far from the horizontal position. They direct us to the Pole Star (α of the Little Bear, *Ursa Minor*). The line from this star to the Guardians of the Pole, β and γ, is in about the position of the minute hand of a clock two minutes before an hour. The Dragon (*Draco*) curls over the Little Bear, curving upward on the east, to where its head, high up in the northeast, is marked by the gleaming eyes, β and γ. Under the Little Bear, the Camelopard has at last come upright.

Low down in the west the Lion (*Leo*) is setting. The point of the "Sickle in the Lion" is turned to the horizon; the handle (marked by α and η) is nearly horizontal. Above the Lion's tail is Berenice's Hair (*Coma Berenices*); and between that and the Great Bear's tail our chart shows a solitary star of the Hunting Dogs (*Canes Venatici*). The Crow (*Corvus*) is low down in the southwest, the Cup (*Crater*) beside it, partly set, on the right. Above is *Virgo*, the Virgin. Still higher in the southwest—in fact, with head close to the point overhead—is the Herdsman (*Bootes*), the Crown (*Corona Borealis*) near his southern shoulder marking what was once the Herdsman's uplifted arm.

Low down between the south and southwest we find the head and shoulders of the Centaur (*Centaurus*), who holds the Wolf (*Lupus*) due south. Above the Wolf are the Scales (*Libra*), and above these the Serpent (*Serpens*), his head, in the south, stretching toward the Crown. In the mid-sky, toward the southeast, we find the Serpent Bearer (*Ophiuchus* — one star of the Serpent lies east of him). Below the Serpent Bearer we find the Scorpion (*Scorpio*), now fully risen, and showing truly scorpionic form. Beside the Scorpion is the Archer (*Sagittarius*), low down in the southeast. To his left we see, low down, two stars marking the head of the Sea Goat (*Capricornus*), and one belonging to the Water Bearer (*Aquarius*). Above the Sea Goat flies the Eagle (*Aquila*), with the bright star Altair; and above, near the point overhead, is the kneeling *Hercules*. Due east, we see part of the Winged Horse (*Pegasus*); above that, the little Dolphin (*Delphinus*), and higher, the Swan (*Cygnus*) and the Lyre (*Lyra*), with the beautiful bluish-white star Vega.

Lastly, low down, between north and northeast, we find the Seated Lady (*Cassiopeia*); and above, somewhat eastwardly, the inconspicuous constellation *Cepheus*, Cassiopeia's royal husband.



In the map, stars of the first magnitude are eight-pointed; second magnitude, six-pointed; third magnitude, five-pointed; fourth magnitude (a few), four-pointed; fifth magnitude (very few), three-pointed, counting the points only as shown in the solid outline, without the intermediate lines signifying star rays.

The Polarity of Tadpoles.

The following, says the *Centralblatt fur Elektrotechnik*, is reported about an interesting experiment of the physiologist Prof. L. Herman. In a flat bowl filled with water, in which a number of 14 days' old frog larvæ (of *Rana temporaria*) were disporting themselves, were sunk along the narrow side, ready for an experiment, thick zinc wires connected with a battery of 20 little zinc carbon elements. When the current was made, the whole of the little animals fell into a wriggling motion, which soon ceased. But all the larvæ without exception had taken up one position, in which the head was turned to the anode and the tail to the cathode. The animals remained in this position till the current was again broken, when they again fell into the wriggling motion, but now less violently. Repeated experiments proved that the living animals showed a decided polarity, placing themselves along the stream lines of a current with their heads all in one direction, this direction being reversed when the current was reversed. An explanation of this interesting phenomenon has not hitherto been given.

ALUM gives excellent results when it has been found desirable to clarify muddy or turbid waters.

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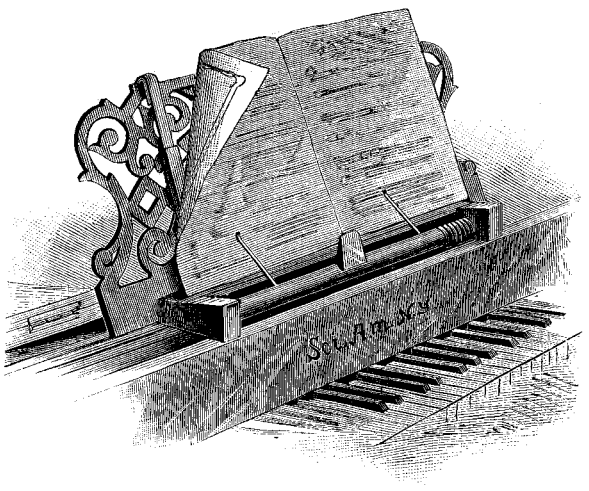
MUSIC HOLDER.

This music holder is provided with hooked arms for attaching it to the music rack. The upper parts of the arms slide freely in the lower parts, so that they can be drawn out or shoved in to fit the rack to which the holder is to be applied. Between the end blocks of the base is journaled a rod provided with fingers, which are pressed against the leaves of the book or sheet of music by the tension of a coiled spring. In the center of the rod is a thumbpiece, by which the rod may be turned back, so that the fingers will permit



SMITH'S MUSIC HOLDER.

the leaves to be turned. When not in use, the arms are folded along the base, to enable the holder to be put away in small compass. Constructed in this manner, the holder is cheap and practical, and can be applied to any piano.

This invention has been patented by Mr. David E. Smith, of Mount Kisco, N. Y.

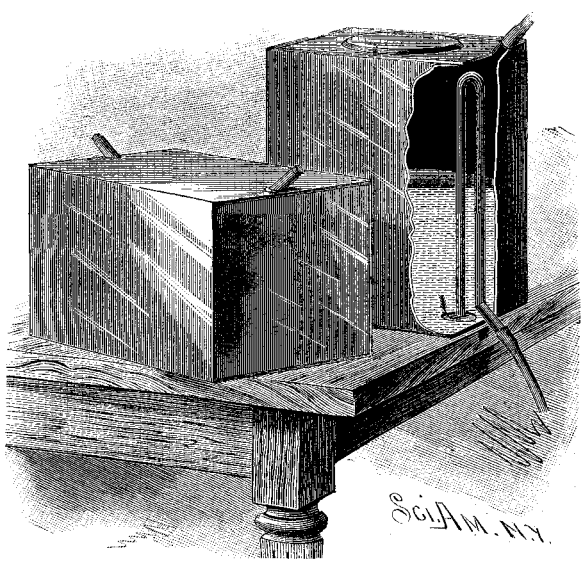
Destruction of Moss in Greensward.

In humid soils, moss develops frequently in grass which is not very old, and completely smothers it. *La Revue Horticole* proposes the following method to get rid of this invading vegetation.

In the month of July, when it is very dry, have the lawn cut at times with a sickle, or with a lawn mower —grass, moss, and everything close to the ground. The sun's rays will in a few days destroy the roots of the mosses, which thrive at the top of the earth. The greensward will suffer very little, but it will be immediately free of all parasitic vegetation. If the necessary care be given, that is, by copious waterings, in a very short time it will become green and thicker than ever. It is not to be forgotten that, in sowing lawns, if powdered lime be cast, the mosses will soon become destroyed.

LIQUID EMPTIER.

The short arm of a siphon secured in one side of the can, as shown in the right hand figure, extends nearly to the bottom, while the long arm extends through the side to receive a rubber tube. A short air tube is inserted in the side of the can, near the top. To fill the can, the side opposite the siphon is placed upon a support, as shown in the left hand figure, when the liquid is poured in through the air tube, the air from the can escaping through the siphon. When filled, both tubes are capped and sealed. To empty the can, a slight air pressure is created by blowing through the



GASCA'S LIQUID EMPTIER.

air tube, when the liquid fills the siphon, which continues to work as long as the liquid is supplied or until a partial vacuum is formed in the can by withdrawing part of the air through the air tube. To insure the entire removal of the liquid, the inner end of the siphon is inserted in a cavity in the bottom.

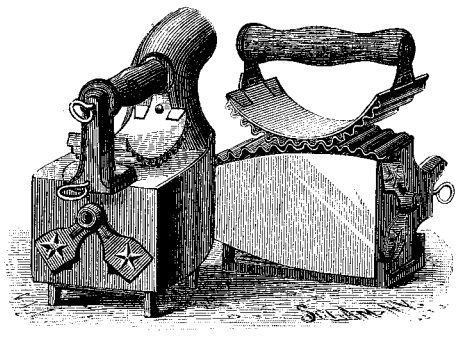
This invention, has been patented by Mr. Jesus Gasca, of Guanajuato, Mexico.

A New Electrotyping Solution.

Dr. Gore, F.R.S., the well known authority on electro-deposition, has discovered that an aqueous solution of asparagine is a good medium for electrolytic baths. The solution he used was not quite saturated, and consisted of about 0·88 gramme of crystals of asparagine dissolved in 18 cubic centimeters of distilled water. It was feebly acid to the test paper, and was employed at a temperature of about 70 degrees Cent. Some of the liquid was more or less saturated with different metallic oxides, and the resulting baths electrolyzed by currents from one to six cells of zinc and platinum in dilute sulphuric acid. Good deposits of cadmium were thus obtained, 0·23 gramme of hydrate oxide of cadmium dissolved in 20 cubic centimeters of the solution, using an anode of cadmium and a cathode of copper. Zinc was deposited from 0·28 gramme of zinc oxide in 23 cubic centimeters of solution. Magnesium in a film was also deposited from calcined magnesia with magnesium and copper electrodes; copper was obtained from cupric oxide with copper and platinum electrodes; mercury from red mercurous oxide with platinum electrodes; and silver from oxide of silver with a silver anode and platinum cathode. In the latter case the deposit was good, the bath consisting of 0·33 gramme of silver oxide in 20 cubic centimeters of asparagine solution.

IMPROVED SAD IRON.

This iron is in fact a miniature stove with polished surface, and is used in the same manner and is as convenient as a common flat iron. The heat can be regulated by the dampers at the heel of the iron; when using the iron, these dampers, which also serve as doors through which to introduce the fuel (charcoal), are wide open, and by partly or entirely closing them the heat can be reduced should the iron get too hot. Upon the under side of the handle, which is detachable, is a curved fluting iron corresponding with a fluted piece fixed to the side of the main iron, as shown in the engraving. It will be seen that this simple construction forms a self-heating, fluting, polishing, and smoothing iron.



THE MULTUM-IN-PARVO IRON.

This invention has been patented by Mr. H. S. Pease, of Peoria, Ill.

The Railroads of the World.

The *Archiv fur Eisenbahnwesen* gives statistics of the railroads of the world, prepared for the most part from official sources, making the aggregate length, at the end of 1884, 290,750 miles, of which no less than 62,788 miles have been opened since 1879. Of this there were in the several grand divisions of the world:

	1884.	1880.	Increase.	P. c.
Europe	117,694	104,606	13,088	12·5
Asia	12,757	9,905	2,852	28·8
Africa	4,075	2,842	1,233	43·4
America	148,738	105,766	42,972	40·6
Australia	7,486	4,844	2,642	54·5

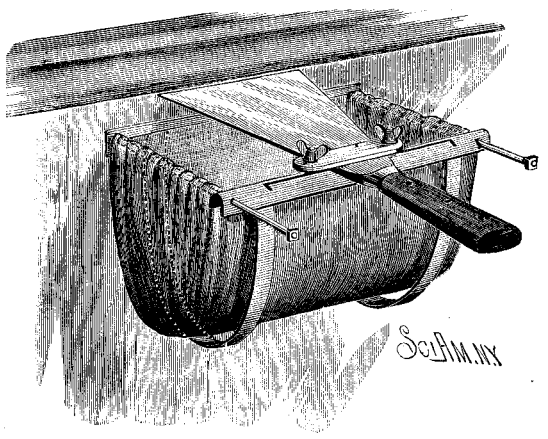
Of the 290,750 miles of railroad in the world, no less than 174,016, or 60 per cent, are in English speaking countries. The countries which have the greatest mileage in proportion to population, or the smallest number of inhabitants per mile, are Australia (364 people per mile), the United States (460), and Canada (486). Even the Argentine Republic has a smaller population per mile than any European country, namely, 1,000; while in Europe, Sweden, which has fewest, has 1,113; Great Britain and Ireland, 1,870; Germany, 1,983; France, 1,943; Belgium, 2,106; Austria-Hungary, 2,786.

The cost of railroads, as is well known, has been greatest in Great Britain, being there $205,842 per mile of roads; for the Belgian state railroads it is $123,986; for the French railroads, $124,642; for the German state railroads, $105,204; for the German private roads, $71,877; for the Austro-Hungarian roads, $104,420. The cheapest system of Europe is the state railroads of Finland, $30,102; the other Russian railroads stand at $82,244, against $63,250 per mile for the railroads of the United States.

The whole cost of the railroads of the world has been more than $24,000,000,000, which, however, is only about $24 per inhabitant. In this country the expenditure has been about $133 per inhabitant; in Great Britain, $107; in Germany, $47; in France, $57; in Austria-Hungary, $33; in Italy, $19; in Belgium, $41; in Sweden, $25; in Spain, $29; in Russia, $14; in Canada, $89.

SCRAPING KNIFE FOR PAINTERS.

Attached to the scraper is a bag of canvas or other fabric held in an elastic frame composed of spring bows joined by cross pieces and rods that form the upper side pieces of the bag. The rods are made fast to the rear cross piece, but pass loosely through holes made near the ends of the front cross piece, through which they slide when the receptacle is partly closed, as shown in the engraving. The front cross piece is made half tubular, and is slotted for the passage of screws, by which the knife and bag are fastened together. By loosening the screws, the knife can be shifted to stand near the center or near either end. By the use of this



O'NEIL'S SCRAPING KNIFE FOR PAINTERS.

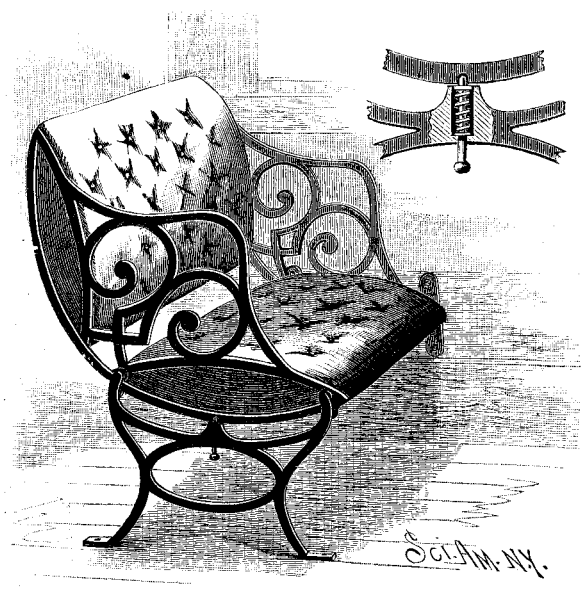
device, which is the invention of Messrs. Charles and Richard O'Neil, of 219 East 46th Street, New York city, all debris removed from a wall in scraping it may be caught in the receptacle; and by shifting the knife its corners may be moved along a moulding or angle, and as the receptacle can be opened and closed to and from the knife, it will not interfere with the edge of the knife, being shoved with a forward thrust entirely up to a moulding or wall.

Preparing Leaves to Show Starch Grains.

The leaf, according to Prof. J. Sachs, must be bleached and made transparent in this way: The fresh leaf is placed in boiling water for ten minutes, then the chlorophyl is extracted with alcohol. This decolorizes the leaf without rupturing the starch cells. Treatment with iodine then makes the starch visible, and the greater or less intensity of the blue color is an apparent indication of the greater or less quantity of starch. Comparative experiments may be made by exposing part of a leaf to sunshine and protecting the other part. In the evening a leaf shows much more starch than in the morning.

IMPROVED CAR SEAT.

This seat is so made that it can be readily reversed without interfering with other seats in the car. The end frames consist of a single casting, shaped as clearly shown in the engraving. The rail is formed on a circular curve, and is grooved longitudinally on opposite sides, and received between grooved rollers supported by the end pieces of the seat frame or by one end piece and plates secured to the wall of the car. The cushions are supported by the curved rails and bars as shown, and act interchangeably as seat and back; the ends of the frame are symmetrical in form, so that they present the same appearance in both positions. The seat is held securely in either position by a spring bolt



WOODMANSEE'S IMPROVED CAR SEAT.

passing through a socket in the upper cross bar of the end piece, as shown in the small cut, and entering one of the notches formed in the curved rail. To reverse the seat, the bolt is withdrawn, when the back can be pushed down in a circular path until it occupies a horizontal position and serves as the seat.

This invention has been patented by Mr. Charles H. Woodmansee, of Norton, Kansas.

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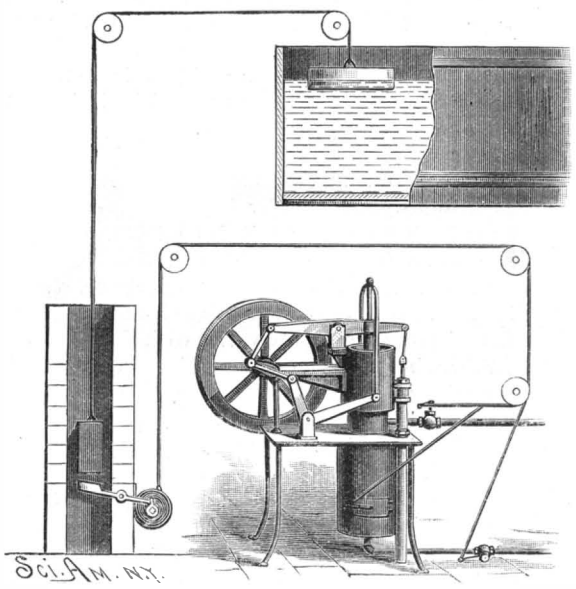
AUTOMATIC STOP FOR ENGINES.

The engraving represents a device for automatically stopping pumping engines, particularly hot air engines used for raising water to tanks. To the engine is fitted an escape pipe provided with a valve, the stem of which has a lever. Connected to this lever is a cord or wire that passes over pulleys and down to a wheel on a shaft journaled in bearings attached to a casing. The shaft is provided with a spring for turning it for winding up the cord to open the valve or other device for stopping the engine. The shaft is turned for winding up the spring by a crank; it is locked by a pivoted trip lever engaging with a projection on the shaft. In the casing is a weight attached to a cord leading to a float in the tank. The cord is so arranged as to raise the weight when the float descends. As the tank fills the weight descends, trips the lever, when the spring turns the shaft to wind up the cord, thereby opening the valve and allowing the hot air to escape from the engine and cause it to stop. In some cases, instead of attaching the cord to the valve, it may be fastened to the furnace door, which will then be opened by the action of the spring. Where gas is used for fuel, the spring may be made to close the cock in the supply pipe. By thus automatically stopping the engine by the rising of the water in the tank, there is no danger of overflowing, and the engine requires no attention when in operation.



ROBERTS' AUTOMATIC STOP FOR ENGINES.

This invention has been patented by Mr. B. J. Roberts, of 126 East 19th Street, New York city.

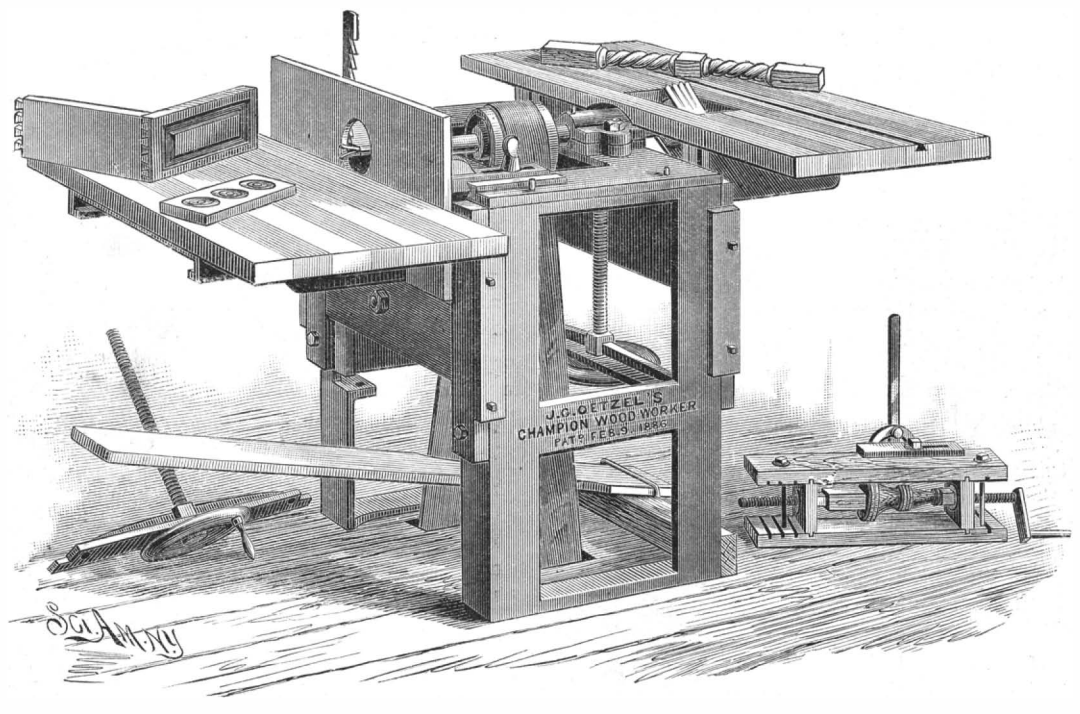
IMPROVED WOODWORKING MACHINE.

This machine is designed for the cabinet shop, particularly where power and shop room are limited; it contains no complicated parts, and can with very few attachments and tools be successfully applied to almost every variety of woodwork. The cutter for forming dovetails is held in one end of a shaft mounted in bearings attached to the top of the frame. The cutter projects through an opening in a vertical guide plate so arranged that it can be adjusted out or in, to allow the cutter to make a shallower or deeper dovetail as may be desired. The feed table moves easily out and in, but has no lateral movement, and can be locked in the desired position. Upon the inner side of the middle part of the bracket supporting the feed table is formed a lug to which is secured a chain passing over a pulley and thence to a treadle hinged to the frame; by operating this treadle, the feed table can be raised to bring the work against the cutter. The timber to be dovetailed is placed with its edge upon the feed table and its side resting against the vertical guide plate, when it is moved forward until the tool has cut a recess to the desired depth. The timber is then drawn back, the feed table is lowered through a space equal to the distance between the dovetails, and is again shoved forward against the cutter. To form dovetail tongues, a number of pieces of timber are clamped together side by side, are placed edgewise upon the feed table, with their ends resting against the guide plate, and are moved laterally against the cutter, which forms a dovetailed groove across the ends. The table is then lowered and the opposite sides cut, and so on until the tongues have been finished on all sides.

To the other end of the shaft is attached an extension to serve as a mandrel to receive a saw or cutter head. This feed table can be raised or lowered, to allow the tool to cut to the desired depth, by means of a hand screw, which is swiveled to a cross bar secured to the frame. By turning the hand screw, the table can be adjusted to permit of the work being placed above or below the cutter or saw, as the character of the work may render most convenient. When used for cutting grooves, a gauge and guide cleat is attached to the table.

By using suitable tools and properly adjusting the parts, this machine can also be used as a boring machine with sliding table; as a double-headed moulding cutter for straight, circular, or other shapes; as a paneling and rosette cutting machine; and as a dado and routing machine. It is also effective for squaring the heads of turned front legs of sofas and chairs, and it can be easily adapted for cutting "rope or spiral" turning.

This machine is the invention of Mr. John G. Oetzel, whose address is care of Messrs. M. & H. Schrenkeisen, of 160 to 166 Monroe St., New York city.



THE CHAMPION WOODWORKER.

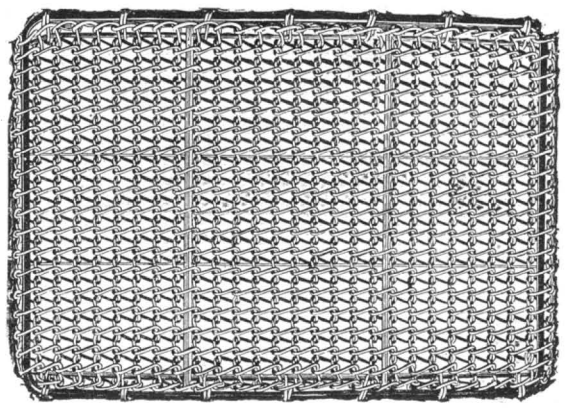
The Coupler Fiend.

Since it became known that the Commissioners were interested in saving the lives and limbs of railroad employes by securing the application of automatic couplers, the inventors have forwarded them models of every conceivable kind of mechanical appliances for car coupling. Some of them are decidedly ingenious, others are cumbersome, while a few are constructed upon the principle that freight cars should be locked together as tightly as the jaws of a steel vise. Railroad men are agreed that there should be some play in couplings for freight cars, and they pass over models which do not recognize this principle. Some of the couplings are made to be operated by a lever projecting beyond the side of the car. Others seem to be constructed for operation solely from the tops of cars. One of the simplest of the collection now in the Railroad Commissioners' office was invented by a mechanic employed by the New York Central. Every inventor who forwards his model invariably accompanies it with the modest explanation that "this is the best thing ever yet invented."

"Probably a hundred models have been sent to the Commissioners, perhaps more," said Secretary Hudson. "Many of them are exceedingly ingenious. Some of them are so expensive that they are impracticable. I remember sitting here in the office one day when a chap came in, followed by five associates. Each of them had a bundle. The leader just cast one glance at me, and then without a word he undid his bundle, and commenced to lay a miniature railroad track all around the floor and into the Commissioners' private rooms. The fifth man produced a lot of cars, and the last man drew a locomotive out of his package. Then I began to get interested. The leader arranged the track so that it ran up and down heavy grades and around sharp curves. Then he lighted a match, touched it to the locomotive, and away went the miniature train at a great rate of speed. Then he purposely caused an accident to the train, and the object of the invention became apparent at once. Every car uncoupled from its neighbor as if by magic. Some of them remained on the track and others toppled to the floor. He repeated this several times, and each time the mechanism completely demonstrated that the cars immediately become detached from each other. It was the most ingenious device I ever saw. The amount of gearing and mechanism necessary for each car simply made the invention enormously costly, and of course impracticable. He thought he had fortune by the throat, and I could not convince him to the contrary. I yielded to his solicitations for letters of introduction to two practical railroad men, and away he went. I afterward received notice from these gentlemen that my life would be in danger if I ever sent any more inventors to them."—*Albany Corres. New York Times.*

STEEL WIRE DOOR MAT.

The accompanying engraving represents a door mat that is rapidly coming into favor, and is particularly adapted for railway and street car floors, steamboats, offices, stores, residences, etc. It is made of steel wire, with steel frame and steel braces, all perfectly galvanized. This gives it many decided advantages; it is serviceable, practically indestructible, is self-cleaning,



STEEL WIRE DOOR MAT.

requiring no shaking, and cheap. These mats are manufactured by the Hartman Steel Co. (Limited), of Beaver Falls, Pa., in six standard sizes, varying from 16 by 24 inches to 36 by 48 inches; special sizes and shapes are made when desired.

Ancient Condition of Egypt.

At the recent meeting of the Victoria Institute, Prof. Hull, F.R.S., Director of the Geological Survey of Ireland, delivered the address, in which he gave an account of the work, discoveries, and general results of the recent geological and geographical expedition to Arabia and Western Palestine, of which he had charge. Prof. Hull, having sketched the course taken by the scientific expedition (which to a considerable extent took the route ascribed to the Israelites), the physical features of the country, evidences of raised beaches, etc., showed that at one time an arm of the Mediterranean had occupied the valley of the Nile as far as the first cataract, the level of the land being 200 feet lower than at present (an opinion which had also been arrived at by another of the Institute's members, Sir W. Dawson), and that, at the time of the Exodus, the Red Sea ran up into the Bitter Lakes, and clearly must have formed a barrier to the travelers' progress at that time. He then alluded to the great changes of elevation in the land eastward of these lakes, mentioning that the waters of the Jordan valley once stood 1,300 feet above their present height. The various geological and geographical features of the country were so described as to make the address a condensed report of all that is now known of that part of the East.

Solidified Oxygen.

At the Royal Institution recently, Professor Dewar exhibited the method he employs for the production of solid oxygen. Last year the Professor gave a lecture on liquid air; but although he and other experimenters had made liquid oxygen in small quantity, yet no one had succeeded in getting oxygen into the solid condition. The successful device employed at the Royal Institution depends upon allowing liquid oxygen to expand into a partial vacuum, when the enormous absorption of heat which accompanies the expansion results in the production of the solid substance. Oxygen in this condition resembles snow in appearance, and has a temperature about 200 degrees Centigrade below the freezing point of water.

A supply of this material will enable chemists to approach the absolute zero of temperature and to investigate many interesting changes in the physical properties of bodies under the primordial condition of the temperature of space.

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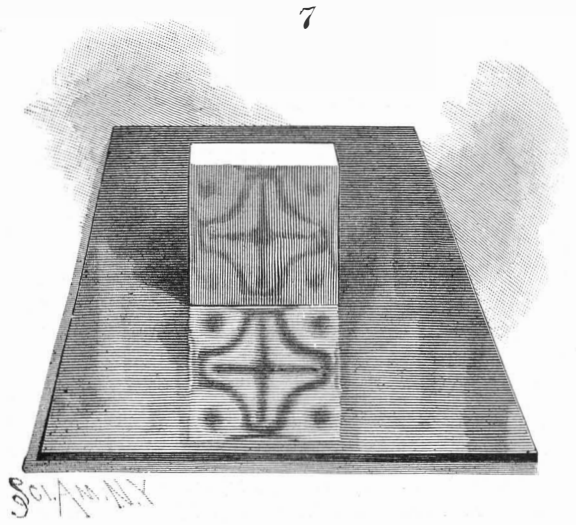
SIMPLE EXPERIMENTS IN POLARIZED LIGHT.

(*Continued from first page.*)

The most perfect analyzer, however, is the Nicol prism.* A very small one will answer perfectly for this class of experiments, and is not expensive. But to return to our experiments; when the analyzer and polarizer are crossed and the field is dark, if a few pieces of mica of various thicknesses and shapes are held between the analyzer and the black glass plate, and bowed and inclined at different angles, a great variety of tints will be observed, and if held in one position while the analyzer is turned, another effect will be noticed.

Among the objects which may be examined in this way are the paper weights, stoppers, and other thick, partly annealed pieces of glass, a piece of glass held edgewise in a hand vise or pair of pliers and put under compression, as shown in Fig. 5. A piece of glass held edgewise for a moment in a small gas or candle flame, and then placed in the polarized beam, shows the strain by a light figure, like that represented in Fig. 6, or it may assume other forms, according to circumstances. As the glass cools, the figure fades away.

Small glass squares and triangular and diamond-shaped plates, about three-quarter inch across, suspended by a fine wire in the flame of a Bunsen burner or alcohol lamp until their corners begin to fuse, and then cooled in air, become permanently strained, and exhibit symmetrical figures formed of dark and light



DOUBLE POLARIZATION WITH SINGLE GLASS PLATE.

spaces, but show little color on account of their thinness. By superposing several such plates, color effects may be seen.

The beautiful *verre trempe*, or strained glass blocks, a few examples of which are represented at *a*, *b*, *c*, *d*, in Fig. 2, are similar in character to what has just been described. They vary in thickness from one-fourth inch to one-half inch, and even thicker. They are expensive objects, but exceedingly beautiful and interesting.

In Fig. 3 is shown a method of polarizing and analyzing with a single bundle of plates. It is, in principle, a Norremberg doubler. The light strikes the under surface bundle of plates at the polarizing angle, and is reflected downward in a polarized state, passing through the object which rests upon the horizontal silvered mirror. It is then reflected back through the object, and passes through the bundle of plates to the eye of the observer; the plates, as before stated, serving to analyze the polarized beam.

A Norremberg doubler, which answers a good purpose, may be made by leaning a clear plate of glass upon the edge of a book, over a piece of ordinary looking glass, and employing a bundle of glass plates as an analyzer, as shown in Fig. 4. Here the polarization is effected by the single plate of glass, and the analyzation by the bundle of plates held in the fingers. Equipped with this instrument, the student of polarized light may proceed a long way with his investigations.

In this intrument the objects to be examined are laid upon the horizontal mirror, and the inclined plate is arranged with reference to the light so that it will reflect the broad light of the sky downward. The position of the single plate and bundle of plates may be varied to secure the best effects.

In Fig. 7 is shown an arrangement by which the object and the blackened glass both act simultaneously as polarizer and analyzer. By placing a specimen of *verre trempe* edgewise on the blackened glass, as shown in the engraving, the light, striking the strained glass at about the polarizing angle, is reflected from the back surface of the glass and partly polarized. The beam thus polarized is reflected downward obliquely, and at the same time depolarized by the strained body of the glass; it is reflected upward to the eye and analyzed by the blackened glass mirror, thus producing an image which is apparently below the surface of the mirror. The image seen in the *verre trempe* itself is produced by the reverse of what has just been described. The light is polarized and reflected by the black glass mirror, and passes through to the back surface of the *verre trempe*, which reflects it back through the body of the glass; the glass then acts as both object and analyzer.

When the polarizer, analyzer, and object are each movable, different effects will be produced by rotating any of them. As a means of exhibiting complementary colors, nothing can excel the polariscope, as the colors produced in the successive changes resulting from turning the analyzer or polarizer are exactly complementary to each other. Little has been said about theories. The writer's object is to interest the reader in polarized light sufficiently to induce him to study the literature of the subject.

* For description see SUPPLEMENT 538.

House Bill 4458.

The Patent Bar Association of Chicago have sent to Congress the following petition, which very ably sets forth the serious objections to the above bill, to which we have heretofore called the attention of our readers:

Whereas, It is the sense of the "Patent Bar Association," of Chicago, Ill., composed of patent lawyers representing varied and diverse interests dependent upon letters patents for inventions, that the "Townsend" bill (No. 4458), now pending in the House of Representatives, is unconstitutional, inherently and radically wrong in principle, and calculated, if it becomes a law, to work great hardship and injustice to meritorious inventors, in the following particulars, to wit:

First.—In that, by not excepting from the operation of the bill patents heretofore granted, it directly interferes with and takes away rights already vested under said patents.

Second.—In that it deprives inventors of the exclusive rights to their discoveries or inventions, contrary to the provisions of Section 8 of Article 1 of the Constitution of the United States.

Third.—In that its provisions are so vague and ambiguous that it will enormously multiply litigation, and will for several years render it impossible to determine what are the legal rights and remedies of the owners of letters patent.

Fourth.—In that it is "class" legislation as against the products of the brains of inventors, while the exclusive rights of authors are fully protected by the laws of Congress.

Fifth.—In that it takes away the jurisdiction of the Circuit and District Courts of the U. S., in suits for infringement of patents involving less than $200, without designating any tribunal for the hearing and adjudicating thereof, thereby depriving patentees having small claims of any remedy, legal or equitable.

Sixth.—In that its provisions are a direct temptation and incitement to fraud as to knowledge or notice of the grant of letters patent for invention, and in permitting an infringing purchaser for use, whose wrong is begun innocently, to continue the same deliberately, after notice during the life of the patent; and,

Seventh.—In that it extends to infringing manufacturers, who are supposed to engage in business deliberately and with their eyes open, the same privileges and exemptions as are extended to innocent purchasers buying in open market; therefore, be it

Resolved, That this Association respectfully and earnestly petitions Congress not to pass said bill—H. R. 4458.

Resolved, That our Senators and Representatives in Congress are respectfully requested to oppose the passage of said bill. J. M. THACHER, *President.*

E. S. EVARTS, *Secretary.*

The Making of Rubber Stamps.

The wording of the desired rubber stamp having been correctly set up in ordinary type, the same is locked up and placed upon a level support. Around it is put an iron frame, which will determine the shape and size of the matrix.

By means of a soft brush, the type as well as all surrounding parts, that are to be covered by the plaster of Paris, are well oiled.

For the purpose of making the cast, finely ground fresh plaster of Paris is needed; if of long standing, the same will lose its desirable properties. This plaster of Paris, of which a sufficient quantity should at one time be mixed to the consistency of pap, using clear water, is poured over the frame containing the type in a thin layer, so as to barely cover it. With a stout brush the mixture is driven into all spaces and interstices, until all details are thoroughly covered. After this the remaining pap of plaster of Paris is added until the frame is filled to overflowing. The surface is smoothed down, after the plaster has settled somewhat, and in a short while the matrix in the frame may be removed from the type.

After this it becomes necessary to bake the matrix in an oven for a period of from four to six hours. When thoroughly baked, the matrix should be well brushed with a thin solution of shellac to impart a smooth surface, and at the same time greater strength.

The matrix, at this stage, represents a yellowish-white block, in which the lettering appears indented, but in proper place. The indentation corresponds to the height of the letter upon the piece of type or the marks upon a cut, while the remaining parts should be perfectly smooth and free from holes. This matrix, obtained by a coating from the type or cut, will serve as the mould for the final rubber stamp.

Pieces of caoutchouc are cut to the required size and laid upon the matrix. If pressure is now exerted, the soft mass will adjust itself to fill all the spaces and reproduce the mould invertedly. Indentations become raised matter, and the whole will show as did primarily the type.

But as the caoutchouc has a tendency to return to its previous shape, it becomes necessary to apply the process called vulcanizing. The object is to impart hardness to the rubber, and to prevent its losing the form into which it has been pressed.

To accomplish this, the caoutchouc must be heated to a temperature of from 120 to 130 deg. C. As the substance is ordinarily softened by heat, it is necessary to take some means to prevent it from sticking to the mould. For the purpose soapstone will answer, and the mould, as well as the piece of caoutchouc, should be well brushed or dusted with this substance.

The duration of the heating varies with the thickness of the rubber sheet. As a general thing, from 20 to 30 minutes ought to be sufficient. It may be mentioned here that special apparatus has been constructed for pressing and vulcanizing. The proper vulcanization is of the greatest importance in determining the durability of the stamp.

All that remains to complete the stamps is the mounting of the rubber plate upon a suitable base or handle. This is best done either with zinc or with a solution of caoutchouc in benzine. The surface of the handle, as well as the back part of the stamps, having been covered with such a solution and well pressed together, after drying the entire stamp will be ready for use.—*Amer. Lith. and Printer.*

Compensating Pendulums.

At a recent meeting of the Royal Astronomical Society, London, Dr. Leonard Waldo, of Yale College, described an escapement for clocks of precision, with which he had been making experiments. He said there are several obscure sources of error in the rate of clocks, which have not been properly investigated. It is ordinarily assumed that the pendulum swings in a plane; but this is never actually the case. There is always some deviation from the plane, as may be shown by fixing a reflector on to the pendulum rod, and observing a reflected light on the cross wires of a telescope as the pendulum swings. Then there is always some mobility about the support, which, if the pendulum is heavy, may be a serious cause of error. Then the coefficient of elasticity of the suspension spring is always changing with the temperature. I have found the best results with a very firm and specially built stone arch between two piers, like the piers of a transit instrument, from which to suspend the pendulum. I have had to discard the use of a glass rod and glass jar for mercury, on account of the difficulty of getting a straight uniform rod or an accurate cylinder to contain the mercury; and we have fallen back on the use of a steel jar and steel rod, which, though they are subject to greater expansion, can be accurately turned. I have had to reject altogether zinc and steel gridiron pendulums, on account of their tendency to warp. There is an uncertainty about such pendulums which is totally unexplained. I use a weight of from 45 to 60 pounds of mercury, properly freed from oxide, which is another source of change of rate. The escapement I have used is a modified form of the Denison gravity escapement, which does not want any great amount of power to drive it.

Mr. Buckney said: I should like to make a few remarks on what Dr. Waldo has said, for his experience does not agree with mine. First, as to the mercurial pendulum being better than the zinc and steel compensating pendulum. I much prefer the zinc and steel, especially for large pendulums, for a change of temperature does not act immediately; and with the mercurial pendulum, the rod takes up the new temperature, while only the outside of the mercurial jar is heated, and until the whole of the mercury in the jar is heated the clock will lose. I have made some experiments as to this, and found that a mercurial jar of 2 in. in diameter, which is the ordinary size used, when exposed to a change of temperature of 30°, takes a whole day to steady itself. A jar of 3 in. in diameter took between two and three days to compensate itself. I do not understand why; but the increase of temperature took about double the time to show its effect that the cooling did. With a zinc and steel pendulum the bob can be suspended from its center so as to eliminate all errors due to the expansion of the bob itself, so that the expansion of a large mass need not be considered.

Mr. Inwards: There seems to me to be another objection to the mercurial pendulum which has not been referred to—the mercury, being liquid, always flops about to a certain extent, which must be equivalent to so much friction.

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Correspondence.

The Recent Fire at the Harrison Chemical Works.

To the Editor of the Scientific American:

We notice in your issue of the 12th inst. an item to the effect that during the recent fire at our works a large amount of chemicals were released from the burning building, which entirely destroyed the fire hose, and also that the firemen's lives were constantly endangered because of the chemicals in the neighboring buildings. Kindly correct this erroneous statement.

The building burned, one of a group of buildings devoted to the manufacture of alum, contained nothing but sulphate of alumina, or alum, in solution or in bulk, in either case perfectly harmless. The nearest buildings were acid chambers, which were not injured sufficiently to release any acid, and even if these chambers had been destroyed, the acid could not have come in contact with the hose. The only hose destroyed during the fire was some 150 feet of our own, which was caught by the fire in an exposed position, and burned before it could be removed. The firemen were not exposed to any more danger than at any ordinary fire, as we do not manufacture, either in our alum works or in any of the rest of our factories, any explosive materials; and even had our chambers been destroyed or injured, none of the acid, or chemicals, as you call them, could have come in contact with the fire hose, owing to the peculiar construction of the buildings.

Mr. John R. Cantlin, Chief of the Philadelphia Fire Department, in a letter to us fully confirms our statement, and we beg you will correct your item.

HARRISON BROS. & CO.,
C. LELAND HARRISON.

Philadelphia, June 17, 1886.

How to Increase the Efficiency of Dynamo No. 161.

To the Editor of the Scientific American:

I have just constructed for lecture purposes in this school a dynamo electric machine like that described in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 161, and I have found it possible to increase its efficiency very much by a change in the manner of making the connections, which may be of interest to others who have the same machine.

I connect the brushes with the extremities of the wire passing round the field magnet, thus closing what may be called the inner circuit. I again connect the brushes for the outer circuit. This connection is very effective where the outer circuit has much resistance or is subject to interruption. The greater the resistance in the outer circuit, the stronger the field magnet becomes and the greater the electromotive force of the current. If the outer circuit, is broken, the field magnet, instead of losing its magnetism, becomes stronger, since its coils receive all the current.

Connected as I have described, the machine will decompose water or work a telegraph instrument at a very low speed; and at a high speed will easily raise to a red heat from eight to ten inches of platinum wire, No. 36. It will also run a small arc light or several small incandescent lamps.

When the resistance of the working circuit is very low, and only then, the connections are best made as described in SUPPLEMENT, No. 161.

Of course, I am well aware that this application of short circuits is well known to electricians, but doubtless many who have made and are using this little machine do not know of it. C. FESSENDEN.

P. S.—To change the circuit, as above, it is not necessary to make any change in the construction of the machine. Taking Fig. 3 of description in SUPPLEMENT, No. 161, join n and v by a straight stout wire, and take the current for outside work from p and v or from p and n. C. F.

High School, Napanee, Ontario, Can., June 21, 1886.

Peculiarity of Indian Castings.*

The importation of partly manufactured material is at present exercising considerable influence over many of the native arts of Oriental countries and India. The supply of machine made thread has doubled the village handlooms in some districts of Madras, and gold thread from Germany has enabled the brocade weavers to compete with the imitation brocades sent in from Europe. In some handicrafts, however, the supply of European material has produced a contrary effect. Iron and steel, bar and rod, have displaced an ancient industry, and sheet copper and brass have robbed the founder of half of his work. Formerly the only means of producing sheet metal was by hammering cast plates, an expensive method only resorted to when thin flat coverings were required for wooden or other objects. For very large vessels, where weight was required to be kept down and strength maintained, hammered sheet was used; but generally the founder was employed, to save as much as possible the labor of forming the furnished castings, which required but little beating out, trimming, and brazing. In the case of a bowl or flat jar with a narrow mouth, the founder would prepare a cast not unlike in shape and thickness that of an ordinary flower pot saucer, from which, by constant hammering, the bulbous sides would be formed, projecting beyond the rim, which would remain of its first diameter and thickness. When finished, such a vessel would be nearly double the size of the first cast, and a remarkable example of the native knowledge of the composition of bronzes and annealing processes.

It is worthy of noting that the chief means of detecting modern from old Persian and Saracenic metal vessels is by examining the brazing joins, which in ancient vessels are rare. When not found, a close examination will show the vessel to be a thin casting, the ornamentation being by inlay or chasing and hammering, which, being done after the cast is made, gives the reverse side the appearance of chased sheet metal. So far as I could ascertain, there are three methods of casting practiced in India. The first by moulds in sand; the second, moulds in clay not unlike plasterers' piece moulds; the third, clay moulds formed on a wax model, the *cire perdu* of Europe. The first of these is well known in Europe, but the second is, I believe, now described for the first time.

In preparing the mould, impressions of the various parts of the pattern are taken in clay, and these pieces when nearly dry are, after trimming, stuck neatly together, and kept in place by several layers of mud, in which some fiber is mixed. The mould when ready has but one vent, which, placed on the most convenient side, is carried up into a sort of bottle neck. If the object is small, several moulds are attached together, and the vents united by a single short neck of clay, to which a crucible, inclosed in an egg-shaped ball of clay, is attached. The size of this crucible depends upon the exact amount of metal required to fill the mould or moulds; and this quantity being known by experience, the founder places it inside before closing it up.

No provision is made for the escape of air from the mould when the metal is poured in. The mould and crucible (now in one piece) is allowed to dry; and after several coats of clay, tempered with fiber, have also been well baked on by the sun, the furnace is prepared. This is simply a circular chamber about 2 feet 6 inches in diameter, 2 feet in height, with a perforated hearth and no chimney. Half filled with charcoal, a good heat is obtained by the use of several sheepskin bellows from beneath. When ready, as many moulds as the furnace will hold are placed in it, the crucible end of each being embedded in the fire. A cover is placed over, and the fire kept up until upon examination the moulds are found to be red hot. They are then taken, one at a time, and replaced in a reverse position, the crucibles being now above. The metal flows down into a red hot mould, and penetrates the finest portions of the surface without suffering from air or chilling. The fire is allowed to gradually cool, and when the objects are broken out of their clay covering, the metal is soft and malleable.

The third manner of casting (that by the use of a wax pattern which is destroyed in the moulding) is well known, but in one particular case the process has been carried further than would be at first believed, and of this I will now attempt a description.

The object produced is an anklet, a flexible ring about 4 inches in diameter, made from an endless curb chain. Such curb chain trinkets are common in India, and are generally made from thick silver wire rings interlinked and soldered one by one. In this example the anklet is made of bronze, and consists of a complicated chain of 43 detailed links, the whole being cast by a single operation. The first part of the process is the preparation of a pattern in wax, a delicate work, each link having to pass through four others, and to bear three small knobs or rosettes. These are in two instances but ornaments; the third, however, serves as a channel for the metal to enter each ring. Then commences the most difficult part of the work, each ring having to be slightly separated, and this is effected by painting in a thin coat of fine clay until there is sufficient to form a partition. Other coats of clay are added until a thickness of about half an inch is attained, when a groove is cut round the upper side of the ring, and deepened until the row of knobs is bared. The wax is then melted out, and the mould attached to a crucible as before described. When cast, and the mould broken away, the chain comes out inflexible, being attached to a rod which runs round where the groove is cut. This is broken off, and the chain is complete.

The president of the society before which the paper was read, in proposing a vote of thanks to Mr. Clarke for taking so much trouble in obtaining the specimens exhibited, said that they were very extraordinary things, and the subject was well worth considering carefully. The mould and the crucible were fixed together, as they could see. He knew that Mr. Clarke had had the opportunity of seeing a good many metallurgical processes as practiced in India, and he was very much struck by one point mentioned, namely, the very great use made in India of highly heated moulds, and which he considered was a subject deserving of considerable attention.

*C. Purdon Clarke, C.I.E., Keeper of the Indian Section, South Kensington Museum, as reported in the London *Iron Trade Exchange*.

Petroleum in Egypt.

The recently discovered oil fields in the region of the Red Sea have been carefully examined by Mr. Daley, a Belgian engineer, and promise to be of considerable importance. The entire peninsula of Gimsah, where the oil has been found, is of volcanic structure, and devoid of the slightest trace of vegetation or fresh water. The first oil borings were made at a distance of 400 feet from the sea. At a depth of 156 feet, a copious flow of oil was obtained. It is estimated that 3,200 barrels were discharged in 24 hours, and the flow has since been maintained at the same rate. The petroleum is of a dark greenish color, and limpid. It is mixed with salt water, and discharges carbonic acid gas. By allowing it to stand for some time, the salt water settles to the bottom, and may be drawn off. The surrounding country is quite uninhabited, on account of the absence of drinking water and vegetation. All provisions are supplied from Suez. The climate, however, is healthful, and the otherwise intense heat is moderated by frequent winds.

The Egyptian Government is disposed to do everything necessary for the development of the new industry. Jetties are being constructed, so as to allow vessels to be loaded directly at the wells. It is probable that most of the crude oil will be taken to Cairo for refining.

DECISIONS RELATING TO PATENTS.

U. S. Circuit Court.—Northern District of Illinois.

OHIO STEEL BARB FENCE COMPANY *v.* WASHBURN & MOEN MANUFACTURING COMPANY *et al.*

Gresham, J.

A court of equity will not specifically enforce a contract at the instance of one of the parties who has repeatedly broken it, even if the other party has been guilty of the first breach.

If one party to a contract expects to have it specifically enforced against the other, he must act steadily in good faith, by observing its terms, whether the other party violates his covenants or not.

When a party to a contract has not kept his covenants, but excuses himself on the ground that the other party was guilty of the first breach, whatever remedy there is is at law.

U. S. Circuit Court.—District of Indiana.

HUDNUT *v.* LAFAYETTE HOMINY MILLS *et al.*

PATENT HOMINY MILLS.

In a suit on reissued letters patent No. 10,057, of March 7, 1882, to Theodore Hudnut, it was shown that one of the alleged infringing machines was made in accordance with an earlier patent, and therefore *held* that such machine was not an infringement.

It is not competent for a patentee, by a reissue of his patent, procured after a delay of more than ten years, to so enlarge the scope of his invention as to cover devices patented in the mean while, which were not embraced in the original.

Maryland Court of Appeals.

SCHWARZENBACH *v.* ODORLESS EXCAVATING APPARATUS COMPANY.

Ritchie, J.

Money paid for a license to use a patented invention on representations made in good faith that the patent is valid cannot be recovered back, although the patent turns out to be void.

In such a case, the general principle applies that where a party with full knowledge, actual or imputed, of the facts, there being no duress, fraud, or extortion, voluntarily pays money upon a demand, though not enforceable against him, he cannot recover it back.

A licensee who has paid, or agreed to pay, an annuity in consideration of a license to use a patent privilege which he has had the benefit of, cannot recover back the money or avoid its payment, if not already paid, on the ground that the patent is void.

A Fish Drying Machine Wanted.

A Florida correspondent writes that a demand now exists among the water farms and fisheries on the Gulf coast for a convenient and inexpensive machine for drying fish so that they may be shipped to distant markets, in the same manner that the fruits of the South are now distributed in dried form over large areas of less fertile country. He suggests that some of the readers of the SCIENTIFIC AMERICAN may turn their inventive genius in this direction. According to the De Funiak Springs (Florida) *Signal*, a premium will be offered for the best machine for this purpose exhibited at their autumn fair.

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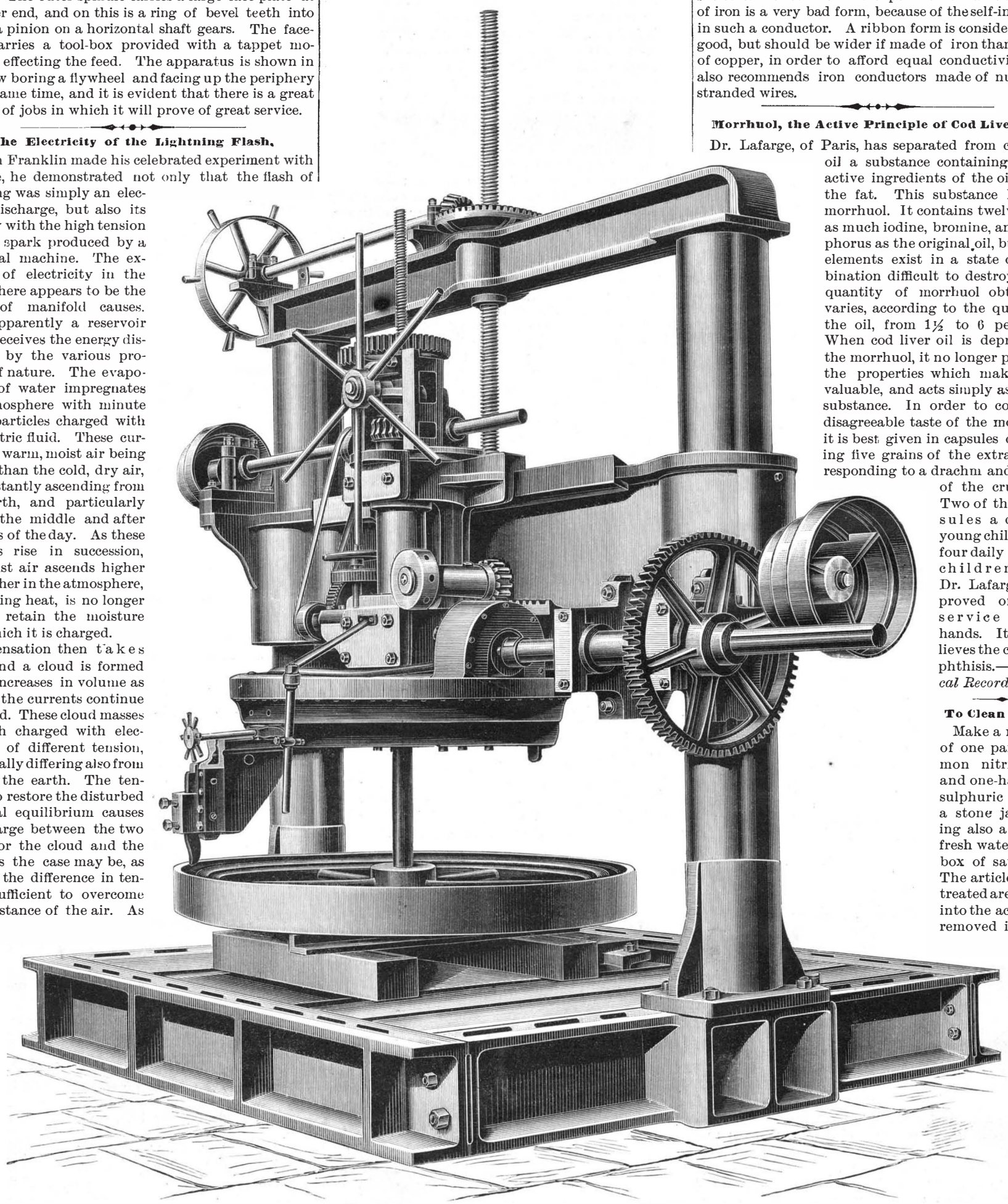
IMPROVED BORING AND FACING MACHINE.

We illustrate a novel boring and facing machine constructed by Messrs. George Waller & Co., of Southwark, London, as given in *Engineering*. It was designed more particularly for the manufacture of gas exhausters, but it is also applicable to a wide range of work. The head slides upon two vertical pillars, and can be raised and lowered by a screw operated by a handwheel. Upon the face of this slide there is mounted a cross-slide, carrying two vertical spindles, one within the other, and each driven separately. The inner spindle is actuated by the cone pulley shown to the left, and is provided with a feed motion after the manner of a drill. The outer spindle carries a large face-plate at its lower end, and on this is a ring of bevel teeth into which a pinion on a horizontal shaft gears. The face-plate carries a tool-box provided with a tappet motion for effecting the feed. The apparatus is shown in the view boring a flywheel and facing up the periphery at the same time, and it is evident that there is a great variety of jobs in which it will prove of great service.



IMPROVED BORING AND FACING MACHINE.

The Electricity of the Lightning Flash.

When Franklin made his celebrated experiment with the kite, he demonstrated not only that the flash of lightning was simply an electrical discharge, but also its identity with the high tension electric spark produced by a frictional machine. The existence of electricity in the atmosphere appears to be the result of manifold causes. It is apparently a reservoir which receives the energy dissipated by the various processes of nature. The evaporation of water impregnates the atmosphere with minute vapor particles charged with the electric fluid. These currents of warm, moist air being lighter than the cold, dry air, are constantly ascending from the earth, and particularly during the middle and after portions of the day. As these currents rise in succession, the moist air ascends higher and higher in the atmosphere, and, losing heat, is no longer able to retain the moisture with which it is charged.

Condensation then takes place, and a cloud is formed which increases in volume as long as the currents continue to ascend. These cloud masses are each charged with electricities of different tension, and usually differing also from that of the earth. The tendency to restore the disturbed electrical equilibrium causes a discharge between the two clouds, or the cloud and the earth, as the case may be, as soon as the difference in tension is sufficient to overcome the resistance of the air. As the resistance of the air is dependent upon distance and humidity, it usually happens that the overcharged cloud discharges into one of less tension and in comparative proximity. Of the many thunder storms occurring every summer, and the frequent flashes of lightning with which they are accompanied, there are probably comparatively very few discharges which ever reach the earth at all. The interchange in the large majority of cases is between two clouds or between two bodies of air of opposite tension. The damage done by lightning would be much in excess of its present total were this not the case. From the passage of the spark from cloud to cloud we need no protection, for the earth is entirely without the circuit.

The entire danger from lightning is when the discharge is between the earth and the cloud. While this discharge is beyond man's control, it is within his power to direct such an electric current so that it shall be harmless. He cannot avert it, but he can, by providing a suitable conductor, prevent in many cases the actual flash, by substituting a silent discharge, or transfer the current through a channel which will be uninjured by its passage. This is the mission of the so-called "lightning rod." There are a number of instances on record where the principle of the lightning rod has been carried out accidentally, with disastrous results, owing to the nature of the conductor. One notable case, probably familiar to some of our readers, occurred many years ago in Brittany, where the church bells were rung at the approach of a storm, in order to warn the people. In several of these churches during the course of the storm, the towers were struck while the bells were still ringing, and the unfortunate persons who had hold of the ropes were either killed or severely injured. Other churches, the bells of which were silent, escaped harm. An explanation of the incident is found in the fact that the large mass of metal of the bells, being in imperfect connection with the ground through the hempen rope and the bell tollers, offered a better conductor for the passage of the electricity than the surrounding air.

The resistance offered by the bodies of the persons completing the circuit was too great, however, for their safety. It often happens that the rods are so carelessly adjusted and maintained that they are inefficient for the protection of the building so equipped. But the value of a properly constructed rod is proved by the experience of the British navy, where no loss has occurred since the adoption of a lightning conductor. The ships are probably struck as often as formerly, but in the absence of an electric explosion, no damage is done.

The best form of conductor is one which offers the least possible resistance to the passage of the current. Prof. Hughes, who has given the subject careful study, states as the result of his experiments that a solid rod of iron is a very bad form, because of the self-induction in such a conductor. A ribbon form is considered very good, but should be wider if made of iron than in case of copper, in order to afford equal conductivity. He also recommends iron conductors made of numerous stranded wires.

Morrhuol, the Active Principle of Cod Liver Oil.

Dr. Lafarge, of Paris, has separated from cod liver oil a substance containing all the active ingredients of the oil except the fat. This substance he calls morrhuol. It contains twelve times as much iodine, bromine, and phosphorus as the original oil, but these elements exist in a state of combination difficult to destroy. The quantity of morrhuol obtainable varies, according to the quality of the oil, from 1½ to 6 per cent. When cod liver oil is deprived of the morrhuol, it no longer possesses the properties which make it so valuable, and acts simply as a fatty substance. In order to cover the disagreeable taste of the morrhuol, it is best given in capsules containing five grains of the extract, corresponding to a drachm and a half of the crude oil. Two of these capsules a day in young children, or four daily in older children, have, Dr. Lafarge says, proved of great service in his hands. It also relieves the cough of phthisis.—*Medical Record.*

To Clean Brass.

Make a mixture of one part common nitric acid and one-half part sulphuric acid in a stone jar, having also a pail of fresh water and a box of saw dust. The articles to be treated are dipped into the acid, then removed into the water, and finally rubbed with saw dust. This immediately changes them to a brilliant color. If the brass has become greasy, it is first dipped in a strong solution of potash and soda in warm water; this cuts the grease so that the acid has free power to act.

CAST IRON pulleys may be lagged with leather without the use of rivets, by first brushing over the surface with acetic acid, which will quickly rust it and gives a rough surface; then attach the leather to the face of the pulley with cement composed of one pound of fish glue and one-half pound of common glue.

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TRIPLE CALLA LILY.

We illustrate in the cut a remarkable example of a triple spathed Calla æthiopica. The specimen is in the possession of Mr. A. T. F. Lampe, florist, of Jersey City. It measures eleven inches from tip to tip of the opposite spathes, and six inches across the face in the opposite direction. Although generally spoken of as the flower of the calla lily, the white spathe is only a slightly modified leaf, and has no relation to any individual blossom. The thick pillar or spadix in the axis is covered with a thick mass of small antheriferous flowers. These are the real blossoms, and the white leaf or spathe that sweeps around the base of the spadix or flower stalk recalls by its shape the green leaves that grow on the regular leaf stalks. The well known Indian turnip and various other plants exhibit this same peculiarity in their way of blossoming. As its name denotes, the C. æthiopica was a native of South Africa. It was introduced into England in 1731. We learn from Mr. Lampe that fifteen years have passed since he saw a triple calla, and that this is the finest one that ever met his observation. The double are not so rare as the triple ones, but either kind can only be called a freak of nature. In all probability, the same plant will never again show the same phenomenon. Out of several thousand flowers that have bloomed in his greenhouses this season, this is the only one of the double or triple variety. There is no way of propagating them.

EXPERIMENTS IN ATMOSPHERIC PRESSURE AND CONDENSATION OF STEAM.

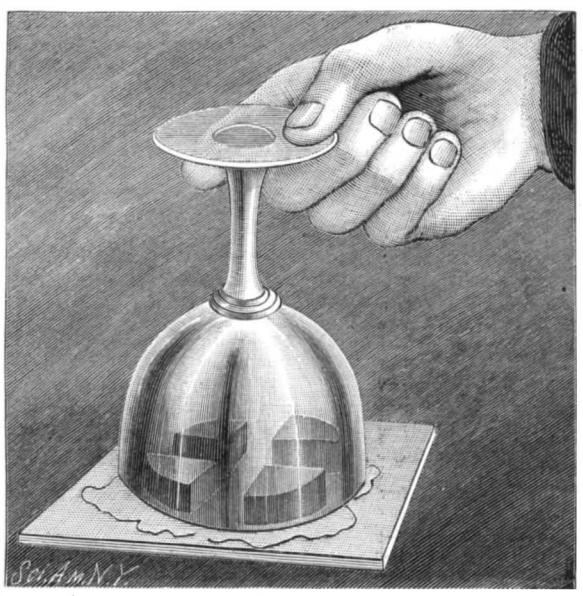
BY T. O'CONOR SLOANE, PH.D.

Since the earliest days of science, the phenomena of atmospheric pressure and different illustrations of the gravity of the air have formed one of the most interesting of the experimental departments of natural philosophy.

While various phenomena connected therewith were known from the earliest days, one of the glories of modern times is the assigning to these facts their true cause. Up to the days of Galileo, the expression of the cause was contained in the words, "nature abhors a vacuum." Inspired by this brilliant man, who was his master in science, Torricelli investigated the subject, and invented the barometer. At about the same period, Pascal, in France, not knowing fully any of the details of Torricelli's work, also investigated the subject of atmospheric pressure, which investigation was one of the classic works of his life. He reasoned out that the barometric column was sustained by the absolute weight of the air pressing upon the mercury outside the tube.

He caused a barometer accordingly to be carried to the top of the Puy de Dome, the principal peak of the Auvergne, situated near the village of Clermont-Ferrand. His brother-in-law Perrier did this for him, watching eagerly the height of the barometric column as he ascended. He found that it fell continually as a greater height was reached, until it was depressed several inches at the summit. This was in exact accordance with Pascal's prediction. In Perrier's words, the result "ravished us with admiration."

Otto von Guericke, the famous burgomaster of Magdeburg, won his title to fame by his experiments in pneumatics. Adjoining the wall of his house he erected a water barometer, whose long tube reached well up to the eaves. On the upper surface of the water within the tube he floated the image of a little



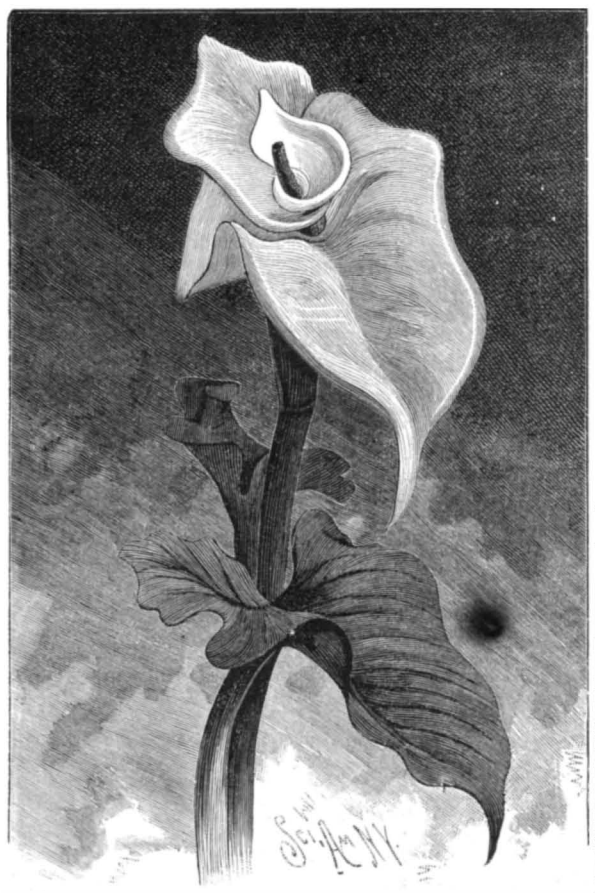
EXPERIMENT IN ATMOSPHERIC PRESSURE.

man, which rose and fell with the barometric column, prognosticating to some extent by his movements the coming weather.

From this experiment it would seem that Von Guericke did things on a large scale.

His other work carries out this idea. He made Magdeburg hemispheres so large that the force of eight horses applied to one of them could not pull them apart. He constructed a cylinder and piston of such dimensions that a large number of his fellow burgomasters pulling simultaneously were unable to raise the piston against the atmospheric pressure. All his experiments he could not have carried out without an air pump, and he has come down to posterity with augmented honor as the inventor of this instrument.

Torricelli, Pascal, and Von Guericke did all the fundamental work in pneumatics, and what has been



TRIPLE CALLA LILY.

since done has been the carrying out of their work to its legitimate conclusion.

In the cut is represented a modification of an old experiment, but which departs sufficiently from it to possess an interest of its own. The original experiment is familiar to many of our readers. A tumbler or wineglass is partly or entirely filled with water, a piece of writing paper is placed over its mouth, is pressed against it tightly by the palm of the hand, and the whole inverted. On withdrawing the hand, the paper remains attached to the glass, and the water does not escape, being upheld by atmospheric pressure.

If the glass was only partly filled with water, the success of the experiment is due to the flexibility of the paper. The paper is pressed into the glass a little by the hand, and when the hand is removed, gives way or bulges out a little.

The effect of this is to permit the rarefaction or expansion of the air contained in the glass above the water; thus, in the usual phrase, etymologically incorrect, but very convenient, a partial vacuum is created, and the paper upheld.

In the modified experiment, an inflexible substance, a plate of glass, is substituted for the paper. To perform the experiment with this, the glass must be completely or very nearly completely filled. The presence of any considerable amount of air in it would cause it to fail, as the glass plate could not bulge out under the pressure of the water. A wineglass or tumbler with very even edge is placed on a level table, filled almost to overflowing with water, and a flat glass plate, by sliding or otherwise, is placed over its mouth, so as to exclude every bubble of air. If this be inverted, the glass plate being held in place while so doing, it will remain attached to the vessel on withdrawal of the hand, but in a state of extremely unstable equilibrium. The plate can hardly be said to be in contact with the edge of the tumbler, a thin film of water intervening, so that on the least inclination the plate slides off. To make it more secure, four pieces of cork may be attached by sealing wax to the surface of the glass that comes next to the tumbler, which prevents this sliding. It is a beautiful illustration of the low expansibility of water.

A small amount of water may be placed in the tumbler, and a little more than an equal volume of alcohol may be mixed with it. A lighted match may now be held within the vessel for a few moments, or until the vapor of alcohol catches fire. After it has got quite warm, a plain piece of glass is placed upon it and it is inverted as before. If this is properly performed, the plate of glass will adhere strongly to the tumbler under the effects of the partial vacuum.

In the other cut, the production of a steam vacuum is illustrated. A small amount of water is brought into a state of ebullition, and maintained so for a few minutes. The flask is then inverted quickly into a bowl containing more than enough water to fill it, its open neck reaching well down to the bottom of the vessel. For a moment nothing happens; but as the steam begins to condense, water rises rapidly into the flask, filling it completely, sometimes with such violence as to break it.

This experiment may be performed with an Italian wine bottle from which the straw cover has been removed. It is an historical experiment, and was performed with one of these identical bottles by Capt. Savery, one of the early inventors of the steam engine. The account of the experiment may be found in vol. ii. of *Experimental Philosophy*, by Dr. Desaguliers, published in London in the year 1734.

Contractors Estimating on Public Works.

The great discrepancy in the bids of contractors for engineering and other public works seems quite a mystery to the uninitiated in such matters, and one we will not attempt to explain. The *Building Trades Journal* seems also unable to explain the reason for the wide difference in the proposals.

Our readers, it says, have doubtless observed the strange discrepancies that existed between the bids on government building work published in these columns every month, and it has given rise to the suspicion that such estimates are a matter of pure guesswork. Private bids are often astonishing in their character, but the difference between them is generally confined to the limits of the percentage which is supposed to represent the margin or profit after the cost of labor and material has been deducted.

With government work there seems to be some unknown quantity not appearing in the clearly drawn specifications which creates a large additional percentage of doubt whether there will be any profit in the work.

As notable examples of the "close margins" which are supposed to be the result of open competition, we select a few figures from contracts awarded since January 1, which ought to provoke some discussion:

For stone work and setting for Louisville, Ky., court house, under advertisement dated November 25, 1886: lowest bid, $86,521; highest, $291,745, or 233 per cent higher.

For iron work for Erie, Pa., court house, advertisement of February 24: lowest bid, $5,818; highest, $10,817, or 86 per cent higher.

For plastering Pensacola, Fla., court house, advertisement of April 1, 1886: lowest bid, $3,243; highest bid, $18,521, or 475 per cent higher.

For approaches to Dubuque, Ia., court house, advertisement of December 3: lowest bid, $549; highest, $1,119, or 106 per cent higher.

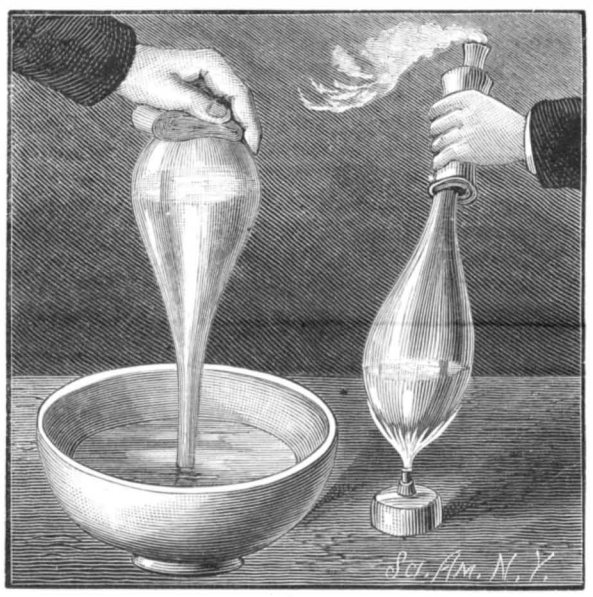
For plastering Toledo, Ohio, court house, advertisement dated November 21: lowest bid, $5,120; highest, $10,000, or 96 per cent higher.

For plaster models for court house at Lynchburg, Va., advertisement of December 10: lowest bid, $78; highest, $1,059, or 1,260 per cent higher.

For iron beams for Brooklyn post office, advertisement of December 5: lowest bid, $1,850; highest, $3,110, or 70 per cent higher.

For lathing and plastering Oxford, Miss., court house, advertisement dated January 7: lowest bid, $1,775; highest, $4,443, or 150 per cent higher.

For iron beams for Pittsburg, Pa., court house, advertisement of January 15: lowest bid, $2,360; highest, $4,617, or nearly 100 per cent higher.



EXPERIMENT IN CONDENSATION OF STEAM.

It would be natural to suppose that the difference in cost of transportation of materials from the various points of supply to the scene of operations would be some excuse for a variance in estimates, but it can hardly seem to account for more than one-fourth, at the most, of the difference of from 75 to 475 per cent between the lowest and highest ideas of the value of the work.

Will some one enlighten us upon the subject?

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ENGINEERING INVENTIONS.

A station indicator for cars has been patented by Mr. William W. Currie, of Smith's Falls, Ontario, Canada. In a box having a glass front are drums and rollers operated by a coiled spring, to draw into view the names of stations, distances, etc., properly arranged upon a ribbon, for the information of passengers, the machine being easily started by a conductor or brakeman.

A car coupling has been patented by Mr. George J. Ferguson, of Greenville, Texas. Combined with a vertical channel intersecting the link throat, and a hooked projection, is an inverted U-shaped coupling, having a hook on its rear side, and a lift arm for raising and sustaining the coupling device, with other novel features, designed to furnish a positive automatic coupling, for coupling cars without going between them.

MISCELLANEOUS INVENTIONS.

A lamp burner has been patented by Mr. Charles E. Tucker, of Salida, Col. The lamp chimney is made to receive an internal auxiliary cone, and holes are made in the sides of this cone near its base, in order to concentrate upon the flame the air drawn into the burner.

An egg preserving crate has been patented by Mr. Nicholas A. Wierman, of Aspers, Pa. It is so made that a large number of eggs may be turned partly over by drawing out the bottoms of several series of compartments in which the eggs are arranged, thereby promoting the keeping of eggs for a long period.

A roller gate hinge has been patented by Mr. George N. Crichton, of Parsons, Kansas. It consists of a bar or plate having a central socket, and provided with a laterally projecting pin near each end, grooved rollers on the pins, and a bolt having an upright arm fitting in the socket of the bar or plate.

A wagon axle has been patented by Mr. John Lucksinger, of Beaufort, Mo. The skeins and cap nut are so made that the axle may be oiled without removing the wheel, and the device is calculated to take up the wear of the skein, so the wheel may always be made to run true upon the axle and prevent chocking.

An automatic check for music boxes has been patented by Mr. Charles E. Juillerat, of New York city. Combined with the cylinder and comb of a musical box is a wheel on the cylinder, a cam wheel, projecting teeth, a pawl and lug, etc., to check the cylinder when the flier cylinder gets out of order or is removed.

A process of and apparatus for coating paper and other fabrics has been patented by Mr. Edward G. Sparks, of Brooklyn, N. Y. It consists in drawing the web of material through a bath of melted wax, paraffine, or other coating substance, the tank having an adjustable slit through which the web passes, carrying the required amount of coating substance.

A pen and pencil holder has been patented by Mr. Frederick P. Peiter, of Norwalk, Conn. It consists of a ring with a diagonal cross piece, on the ends of which loops are formed for receiving the pencil, whereby a pen or pencil may be held on one of the fingers, so as to be very handy for use and out of the way when not in use.

A holder for photographic paper negatives has been patented by Mr. Erastus B. Barker, of New York city. It is in the form of a slide with attached folding or hinged frame, capable of being entered within the ordinary plate holder of a camera, and serving to hold the sensitized paper in position behind the lenses, for taking the photographic picture.

A culm bar has been patented by Mr. Silas M. Hess, of Bloomsburg, Pa. It consists of parallel bars united by cross pieces and slotted sections, each having a V-shaped recess at one end and a V-shaped projection at the other end, and with bottom lugs fitting between the parallel bars, so that the culm may be perfectly burned, without loss.

A carpet stretcher has been patented by Mr. Enos B. Willix, of Dows, Iowa. It consists of two jaws connected by a hinge joint at their outer or front edges, with ribbed meeting faces and adjustably connected levers, with other novel features, the device being designed to subject the carpet to a high strain without injuring the texture of the fabric.

A sled brake has been patented by Mr. Samuel H. Anderson, of Maddensville, Pa. The brake is operated by means of a lever, by operating which the ends of U-shaped dogs are projected to engage with the roadway in such manner as to check the advance of the sled, and also to hold it from running back when stopped on an up grade.

A gate has been patented by Mr. William Mason, of Puyallup, Wash. Ter. It is a sliding gate, with locking latches at its opposite ends, and sliding bars or rods on the top of the gate, an operating cord extending at opposite sides of the gate and connected to the sliding bars, so that a quick pull on either of its handles will unlatch and open or close the gate.

A bicycle shoe has been patented by Mr. Thomas J. Strickland, of Randolph, Mass. The invention consists in a shoe with a buckskin sole, and in a canvas shoe having the bottom parts of its upper made of leather, the shoe being so made as to be very flexible throughout, and so that it cannot slip on the pedal.

A slag cart has been patented by Mr. August Werner, of Leadville, Col. In the bottom of the bowl or ladle receiving the smelted metal, such bowl being suitably mounted in a frame on wheels, is a removable nozzle, so that a longer or shorter nozzle may be used as desired, to facilitate the separating of the matte from the slag.

A funnel has been patented by Mr. Harmannus Van Kammen, of Grandville, Mich. It is a measure, with a conical bottom, in the center of which is a screw-threaded nipple receiving a tube, a yielding valve seat being between the tube and nipple, and a ball valve communicating by a rod with a valve-closing spring attached to the handle of the measure.

A truss has been patented by Mr. John R. Jones, of Emporia, Kansas. The body spring made of flat spring metal, carries pad arms which may be adjusted with clamps to be set at any point in a circle described from the clamp as a center, so the truss may be used with equal facility for either direct, oblique, or femoral hernia.

A velocipede has been patented by Mr. David G. Biggs, of Louisville, Ky. This invention relates principally to a novel arrangement of the crank shaft and connections, whereby all the force or power exerted by the rider is utilized in driving the machine, and the movement is such as to decrease "wabbling" of the machine.

A door hanger has been patented by Mr. Le Grand Terry, of North Elmira, N. Y. This invention covers a novel construction and arrangement of parts to adapt a hanger for sliding doors to be adjustable to doors of different thicknesses, and to permit the door to be swung outward without derailing the hanger or its main wheel.

A nut lock has been patented by Mr. Louis Unger, of San Antonio, Texas. The nut has in its rear face a non-circular recess, whose walls are serrated, and from this recess notches extend to the side of the nut, the locking washer having its edge formed to fit those of the recess, so that when it is in such recess it will be held from turning.

A metallic ceiling has been patented by Mr. John D. Ottiwell, of New York city. Sheet metal mouldings are formed with side flanges, to be nailed to the beams or to furring strips, and the mouldings are made to receive and hold the edges of the panels, avoiding the necessity of nailing them, and facilitating the work of putting up the ceiling.

A sash fastener has been patented by Mr. George N. Clemson, of Middletown, N. Y. It is a spring-acted latch pivoted to a horizontal plate, with a nib projecting beyond the edge, a roller carried by the latch projecting beyond the edge of the nib, to carry the latch past the rail of the upper sash, and a catch for receiving the nib of the latch when the sashes are closed.

A horse collar has been patented by Messrs. William L. Bailey, Leonard T. and Lenis D. Knight, of Calvert, Texas. It is made principally of what is known as "moss yarn," with its strands or fibers arranged, and the body of the collar subjected to pressure in a mould or press, making an easy fitting and self-adjusting collar for farm and other use.

A knockdown crate has been patented by Mr. Charles P. Lewis, of Sweet Springs, W. Va. The end and side pieces are dovetailed together with a square dovetail, and apertured for the insertion of rods to hold the box when set up, on the removal of which the box can be readily folded for shipping, it being adapted for carrying fruit or goods of various kinds.

An automatic check for music boxes has been patented by Mr. Alfred Sueur, of New York city. It is so connected with the music box mechanism that when the latter is rotated too fast a ratchet wheel is made to force a pawl into locking engagement and stop the mechanism, thus preventing the breaking of the pins and the teeth of the comb.

A circular-saw dresser has been patented by Mr. Hyman D. Wolcott, of Wright's, Pa. It consists of a pair of beveled and circular files, mounted in a frame secured to the guiding arms of a saw jointer, arranged to be adjusted to or from the saw and held in yielding connection therewith, and is an improvement on a former patented invention of the same inventor.

A snap hook has been patented by Mr. George R. B. Swanton, of New York city (the Bancroft House). It has a chambered shank, in which is fitted an obliquely sliding bolt, and a spring for projecting the bolt and retaining it in a projected position in the bow of the hook, making a simple and secure hook for use in connection with gate fastening chains, parts of harness, etc.

A churn has been patented by Messrs. Daniel Lines and Charles T. Long, of Milano, Texas. The body of the churn is of stone or earthenware, and preferably square in form, and it has dashers worked in opposite directions by rotating a handle connected with bevel driving gear, the construction being simple and effective, and the churn easily kept thoroughly clean and sweet.

An exhibiting device has been patented by Mr. Joseph P. Wilson, of Centralia, Kan. A clock train, with dial face and hand showing on the front of a case, is arranged to disengage detent mechanism, while a second train drives a carrier shaft carrying radially projecting arms, with various other novel features, constituting an improved device for exhibiting advertisements, photographs, etc.

A drier intended especially for drying tobacco has been patented by Messrs. Gilmer and Chas. N. Meriwether, of Guthrie, Ky. This invention consists of a specially devised sheet metal screen arranged to be suspended above an open fire, to protect tobacco from sparks thrown off during combustion.

A drier, more especially adapted for white lead and other pigments, has been patented by Mr. Arthur Buel, of New York city. Drying belts or aprons are employed, on which the pigments are deposited and heat applied, so the substance will be dried in small lumps or balls, which can be handled without waste, the belts being arranged in vertical series and the material discharged from one to the other while being dried.

A fruit drier has been patented by Mr. William S. Plummer, of San Jose, Cal. The heat conductors are constructed in a manner intended to form a vacuum above the trays, to draw the heated air up through them, thus expediting the evaporation of the juices, and preventing any dampening by the vapors from the lower trays, the invention being an improvement on a former patented invention of the same inventor.

A fishing reel has been patented by Mr. Julius vom Hofe, of Brooklyn, N. Y. The reel heads are made of hard rubber, with the inner metal plates of open work finish, or in the form of braces embedded in the rubber before vulcanizing, with the plates afterward recessed on their inner faces in common with the rubber, to receive the rotating spool heads, making a cheap, light, and strong reel.

A fifth wheel has been patented by Mr. Joseph V. Alexander, of Taylor's Chapel, Tenn. This invention affords an improvement in ball and socket couplings, for connecting the front axles of wagons and carriages to the bolsters, the socket having end openings or slots and the ball a radial slot extending through it, while the axle and its attached block have a segmental form, adapting it to fit in and fill the slot.

An automatic dumping and discharging apparatus has been patented by Mr. John T. Evans, of Adamsville, Utah Ter. Combined with a supporting frame is a pivoted and counterbalanced dumping cage, having one end open and the other curved upwardly, an entry for guiding a bucket into the cage, and a stop for arresting the cage when tilted, to facilitate discharging ore, coal, etc., on cable railways.

A flour bolt has been patented by Mr. Kennedy Dougan, of Calwood, Mo. Within a cylindrical chest is a reel on which is a series of vertically yielding pivots, conveyer wings being mounted on the pivots, and the adjacent surfaces of the wings and reel having projections and recesses to hold the wings in position, the design being to simplify construction, lessen cost, and economize space.

A windmill has been patented by Mr. David B. Wood, of Sibley, Iowa. According to this invention, the floats are arranged in sets and carried by a hollow vertical shaft that is supported in a properly constructed tower, the construction being such as to make a cheap, efficient, and durable form of windmill, the fan arrangement also being applicable to ordinary forms of windmill.

An apparatus for facilitating the multiplication of numbers has been patented by Mr. Jules V. Charpantier, of New Orleans, La. This invention covers improvements on a former patented invention of the same inventor, intended to improve the construction and to better prevent the possibility of misreading the figures of several sheets, or reading from one row figures of one sheet when another should be considered.

A wagon bolster has been patented by Mr. John M. McNees, of West Liberty, Pa. It has at its opposite ends sockets fitted to receive tenons on the lower end of the stakes, a bolt passage intersecting the socket, and the tenon having an edge notch, the fastening bolt entering such edge notch to secure the standard, the bolster being especially adapted for bob sleighs in the lumber regions.

A tailor's measure has been patented by Mr. Anton Schad, of Louisville, Ky. It is a leather belt about an inch wide and fifty inches long, laid off in inches and parts of inches, and on one side is attached a steel band, set a little distance from the plane of the belt, upon which is adjusted a sliding back measure and sliding arms, the measure being intended to facilitate measuring and laying off garments with accuracy.

An instrument for measuring powders has been patented by Mr. Joseph J. Stevens, of Coalesburg, Mo. It consists of a tube on which is a graduated scale, a piston in the tube being adjustable to regulate the quantity of powder, and the powder being then readily forced out by the piston, the device being intended to facilitate the exact and rapid measuring of proper doses in medical practice.

A folding box has been patented by Mr. Jonah R. Cole, of New York city. The bottom is made in one piece with the end and side pieces, the surplus material at the corners being folded and lapped, and eyelets inserted, through which is passed a draw string or tape entirely around the box, so that by drawing upon the ends of the string the box may be drawn to folded position, and so tied.

A car starter has been patented by Messrs. Charles L. N. T. Hansen and Christian N. Fischer, of Plainfield, N. J. The invention consists of an endless chain and pulleys attached to the driving shafts, a clutching device operating on the chain and against springs, there being a brake and a device for throwing the clutch in and out of gear with the chain, the device accumulating power at the will of the operator while the car is in motion.

A bottle stopper forms the subject of two patents issued to Mr. Charles L. Morehouse, of Brooklyn, N. Y. The bottle head has an inner angular groove and triangular rabbet, and a rubber packing ring has a flange to fit in the groove and against the rabbet, while there is a hard rubber or other ball valve fitting against the bottom bevel of the packing ring, with other novel features, the devices making a simple and effective internal and external bottle stopper, adapted for use on bottles for receiving plain and effervescent liquids.

NEW BOOKS AND PUBLICATIONS.

MODERN STEAM ENGINES. By Joshua Rose, M.E. Philadelphia: Henry Carey Baird & Co., 1886.

Though quite elementary in its character, and written almost entirely from the workshop point of view rather than the theoretical, Mr. Rose's latest volume covers almost the whole ground of steam engine construction. It is written in a plain, straightforward style that will commend it highly to those who search for information in its most available form. It is intended for beginners in the study of the steam engine, no less than for more advanced students, since care has been taken to omit nothing that is essential to a thorough understanding of the subject. Particular attention has been given to the various kinds of slide valve motions, as the distinguishing features of each class of engines depend largely upon these differences. Each subject has been treated so as to be complete in itself, and while this has necessitated repetition in several instances, it makes the work much more valuable for reference. Nor is the repetition a disadvantage for its own sake, as the essential features of an engine cannot be learned too thoroughly. In addition to the consideration of the steam engine as a general motor, and its construction for particular classes of service, some little space is devoted to its application to pumps, drills, air compressors, and other mechanisms driven by the direct use of steam. The volume is one that can be cordially recommended, even in the face of the large competition to which all such works are now open.

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Hercules Lacing and Superior Leather Belting made by Page Belting Co., Concord, N. H. See adv. page 382.

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Billings' Double-acting Ratchet Drills. Drop Forgings all kinds. Billings & Spencer Co., Hartford, Conn.

Curtis Pressure Regulator and Steam Trap. See p. 142.

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) F. H. S. asks: In the dynamo described in SUPPLEMENT, No. 161, the wire of the armature is, as I understand, passed between the sections of the copper or brass ferrule of the commutator; do they touch both sections of the ferrule? A. The terminals are attached each to one section of the commutator. 2. How are they fastened—by soldering, or just laid in? A. Soldering with resin flux is best. 3. Is it necessary to alter them from the round shape to fit snug with a smooth surface, and touch the commutator springs? A. The wires do not touch the commutator springs; they need no flattening. 4. What weight of 12 cotton-covered wire would it take on the magnets for one twice the size and one four times the size of the one described? A. 20 pounds and 80 pounds, about. 5. If the machine is left in a damp place, the magnets and armature will be apt to rust; how should it be treated to prevent this? A. They will not rust much if of cast iron. Varnishing will prevent it. 6. In making a U-shaped electro magnet, what is the best wire to use for one 3 or 4 inches long, and would there be much difference if one was wound with 12 and another with 36, using the same battery power? A. It all depends on your battery, line resistance, etc. For experimental lifting magnets use No. 16 to No. 20.

(2) H. G. asks: How much will the expansion of a brass bird cage spring composed of about 6 feet of brass wire about as large as an ordinary darning needle and subject to 100 and to 50 degrees of heat be? And will the expansion run in the wire if it is coiled into a spring as above? A. A brass wire 6 feet in length will expand lineally $\frac{1}{865}$ part of its length, or 0·074 inch, from 32° to 132° Fah.; from 152° Fah. to 182° Fah., 0·037 inch, about. The wire will expand whether coiled or not.

(3) Commander of the Electra asks where he can receive instructions in naval architecture and yacht or ship designing. A. Best with some company such as the Harland & Hollingsworth Manufacturing Company, of Wilmington, Del., or by obtaining admission to Annapolis United States Naval Academy. 2. Has any electric pumping machinery ever been invented? If so, when and where is it procurable? A. Address Edison Electric Company, 65 Fifth Avenue, New York. 3. What is the address of Professor Tuck, the inventor of a submarine torpedo system? A. The Tuck torpedo is owned, we believe, by the Submarine Torpedo Company, 20 West 23d Street, New York city. The inventor Josiah H. L. Tuck, is a resident of San Francisco, Cal.

(4) C. O. writes: 1. Will you please tell me how I can increase my weight? I am over 6 feet tall, and weigh but 150 pounds. Would like to increase it about 25 pounds. A. It will depend upon your constitution whether such increase would be possible. If you enjoy normal health, and have no obstacles in the shape of dyspepsia or other disease, you can probably gain in weight by proper attention to your diet. Milk, taken just before retiring, and slowly sipped in order to permit a thorough mixing with the gastric juices, will be very fattening. The late Dr. Ellerslie Wallace, Dean of Jefferson Medical College, Philadelphia, once recommended one of his broken down students to eat plenty of butter during the summer vacation. In the fall a stout, hearty man presented himself before the Doctor. So great was the change in his appearance, that he had to introduce himself as the invalid student of the previous spring. He had spent the summer at his home in Virginia, and had eaten three pounds of butter a week. It will be unnecessary to add that such a diet must be accompanied by plenty of exercise in the open air, or it would be apt to produce other disorders of the system. 2. Could you tell me from what books I could best learn the principles of political economy? A. We would recommend John Stuart Mill's "Principles of Political Economy" ($3.50); "Money and the Mechanism of Exchange," by W. Stanley Jevons ($1.75); "Physics and Politics," by Walter Bagehot ($1.50); and a long list of others. The subject is a big one.

(5) C. C. F. desires a receipt for ink to renew a Keystone rubber stamp pad one year in use. A. All inks used on this class of pad are made from aniline colors dissolved in glycerine and thickened with gelatine. When they need renewal, the addition of a little glycerine and alcohol may soften and revivify them, but when exhausted they are intended to be thrown away.

(6) R. L. P. asks: What will dissolve gold chloride? I have about eight or twelve grains dissolved in HCl and HNO_3; then I precipitated with hydrogen sulphide, and tried to dissolve the precipitate in a half ounce of cyanide of potassium, with no result. I heated the mixture. What is the trouble? A. Before passing hydrogen sulphide through the gold solution, you had the chloride in solution, and you should have added the cyanide to it. You have precipitated sulphide of gold. Dissolve it in nitric and hydrochloric acids as before.

(7) T. B. asks: 1. How many candle power Edison lamp will the dynamo referred to in 161 supply with electricity? A. Five to ten candles. 2. What horse power is required to run it? A. About one-sixth horse power. 3. How many cells of the Daniell battery, 4 inches diameter and 6 inches high, would supply a four candle lamp? A. Twenty to thirty cells. 4. Who manufactures small dynamos? A. Consult our advertising columns.

(8) J. A. M. asks the best thing to clean a locomotive smokestack, and make it look as black and bright as possible. A. Often wipe down with oil and lampblack. A little plumbago makes the good appearance more durable.

(9) W. H. B. desires a reliable cement for fastening metal to glass—one that will resist the action of water and acids, especially acetic acid. A. Finely powdered litharge, fine dry white sand, and plaster of Paris, each 3 parts by measure, finely pulverized resin 1 part. Mix and make into a paste with boiled linseed oil, to which a little drier has been added, and let it stand four or five hours before using. After fifteen hours' standing, it loses strength. This cement is said to have long been successfully used in the Zoological Gardens, London.

(10) R. S. D. asks: 1. What chemicals are used in Robert's permanganate battery? Give formula. A. Permanganate of potash, bichromate of potash, and an alkali chloride. It is described in United States patents numbers 311,852, 311,853, and 317,206, which we can send you for 25 cents each. 2. Can cast iron that is a little hard, but not so hard but that it can be readily worked, be softened by annealing so as to be as good for electrical purposes as though it was cast very soft? Will it injure a finished piece if it is covered with air-slaked lime and heated to a white heat? A. The proposed annealing of cast iron would tend to improve it, especially if you heated it hot enough to start with. 3. Why is a magnet placed so as to curve around a telephone bell? A. The curved magnet or magnets polarize the armature, so that the intermittent currents passed through the electro-magnets cause it to vibrate. 4. Can you furnish working drawings of a larger dynamo of a different style from the one in SUPPLEMENT, No. 161? A. We hope soon to publish an article on such a dynamo.

(11) W. C., Jr., asks: 1. What is the safe working pressure of a boiler 60 inches diameter by 14 feet long, made of wrought iron ⅛ inch thick, and one of the sheets exposed to the fire having scaled off ⅛ of an inch thickness for a space of 12 inches diameter, longitudinal seams double riveted? I carry 90 pounds pressure; the boilers are eight years old. Number of tubes 51, 3½ inch. A. If the blister is not disposed to run in deeper, the boiler should still be good for 90 pounds steam pressure. Half inch is very heavy iron for a 60 in. shell; a ⅛ in. blister still leaves the iron as thick as most boilers are made of that size. All that is necessary to do is to watch the blister, as it may still spread and become deeper. 2. The best method of preserving this boiler when we do not run but four months in a year. Would you advise me to put lye in the boiler to take scales from tubes while idle? Would it be a good plan to use ½ ounce crude rock oil in boiler while running to prevent scale? A. Lay up your boiler full of water that has been boiled, after having cleaned it. The boiling discharges the air, when it can be shut tight to keep out air. A little carbonate of soda, say 1 pound, put in when the boiler is filled to lie up, will help loosen the scale during the season of lying up. So small a quantity of crude oil will do no harm, and may facilitate the loosening of the scale. The boiler should be cleaned often when oil is used, as it is apt to gather scale and dirt and form an oil cake, which is dangerous when lodged on a fire sheet. 3. Is not plumbago used with piston packing? A. Plumbago is good on piston packing.

(12) C. R. R.—The plan of connecting a battery of 5 boilers with a cross steam dome riveted to the boilers is not good practice, and is the cause of all your trouble. The unequal expansion and contraction strains the necks, and sets the weakest points to leaking. Any cement that can be put in such a place will only be a temporary contrivance; besides, we cannot see how you could insert the cement without taking the joint apart, which would require a disturbance of all the other joints. We cannot recommend any other plan than riveting and calking, or to change the method of connection for the whole battery, so as to make it elastic enough to meet the requirements of expansion. Iron pipe connections arranged to take up displacement by heat between the boilers are preferable to the dome.

(13) J. H. asks how to grind brass water valves. I have ground them together with flour of emery and oil, but cannot do good work; it leaves the valves full of creases inside and out. A. The flour of emery used should be very fine, and the work finished with ground pumice stone. If the valve seats are not badly cut, emery should not be used at all, only the fine pumice.

(14) T. C. J. asks: What kind of a pyrometer is used for registering about 4,000° of heat, as the highest graduated pyrometer that I have seen is 1,500°? A. There are no pyrometers made for so high temperature. The Wedgewood pyrometers, made of clay, registered to 2,500°, but were not reliable. They were in use in England. Pyrometers of platinum rods inclosed in a plumbago tube are probably the most reliable up to 3,000°.

(15) C. W. C. desires (1) a recipe for a stain to imitate mahogany on white birch wood, that will not raise the grain of the wood. A. A dark mahogany stain is made as follows: Boil half a pound of madder and 2 ounces of logwood chips in 1 gallon of water, and brush well over the wood while hot; when dry, go over the whole with pearlash solution, 2 drachms to the quart. 2. Can you give recipe for making the acid stain? A. In the acid stain you take nitric acid, and dilute with 10 parts of water, and wash the wood with it. 3. Are there any books which give full directions for imitating the different woods? A. We would recommend for your purpose Spon's Workshop Receipts (second series), which we can send you, postpaid, for $2.00.

(16) A. R. sends samples of tin and sheet iron finished in colors and figured, and asks how the work is done. A. It is a kind of marbling that is effected much in the same manner as the marbling on book edges, and then varnished. The process requires considerable experience and ingenuity in its artistic accomplishment.

(17) J. R. asks: Is there any preparation that will effectually take out ink from paper without discoloring it? A. A solution of oxalic acid, citric acid, and tartaric acid is attended with the least risk, and may be applied upon the paper without fear of damage. Chloride of lime is also used.

(18) W. M. S. asks: In a photographic lens, where do the rays actually cross to reverse the image on the ground glass? A. The rays from the object cross at the optical axis of the lens between the front and back combinations. It is in the vertical plane of the optical axis that the diaphragms are usually placed.

(19) W. H. P. desires a receipt for citrate magnesia. A. The citrate of magnesia sold in drug stores is made as follows: Calcined magnesia (magnesium oxide) 1¼ pounds (or carbonate, 2 pounds), powdered tartaric acid 1½ pounds, bicarbonate of sodium 1 pound; dry each article by a gentle heat, then mix them; pass the mixture through a fine sieve in a warm dry room, and keep it in well corked bottles. A few drops of essence of lemon and 3 pounds of finely powdered sugar are generally added to the above quantity. This makes it more agreeable. A small quantity of the bicarbonate of soda is added in powder immediately before corking.

(20) C. N. V. C. asks: 1. In what way and to what extent are cigarettes injurious to smokers, especially to inhalers? A. The injury done by cigarettes is much greater than that from the use of cigars. The difference is caused apparently by the fact that the smoke of the cigars is not allowed to enter the lungs, while that from the cigarettes is inhaled, reaching of course a greatly more extended as well as more vital part of the mucous membrane. 2. A remedy for pimples on the face, also for blackheads. A. See article on Face Worms in SUPPLEMENT, 542, of May 22. 3. What is the value of sulphur as a cosmetic wash? A. The value is almost absolutely nothing.

(21) A. E. S. asks: 1. How can I make one of those batteries that workmen use in the streets for blasting? All that I see of the machine is a box, two thumb-screws, and a handle to set it off with. A. What you have seen is probably some form of induction electric machine or of dynamo. See SUPPLEMENT, Nos. 70, 161, 278, 279, 282. 2. Is Atlas powder another name for dynamite? A. It is a brand of dynamite.

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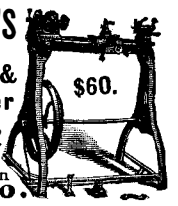

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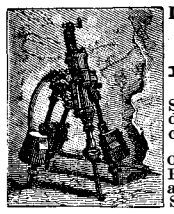

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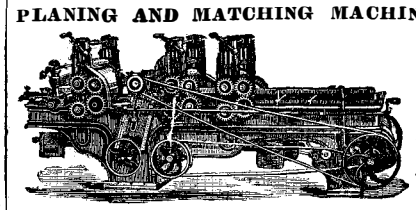

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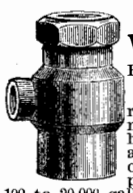

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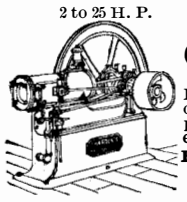
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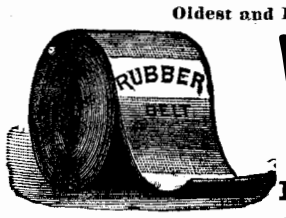

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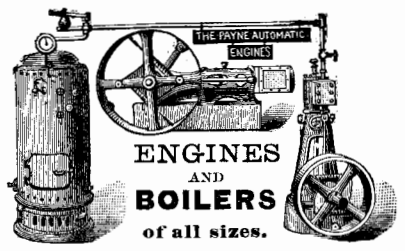

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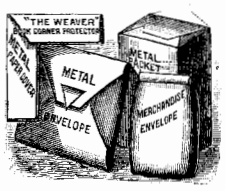

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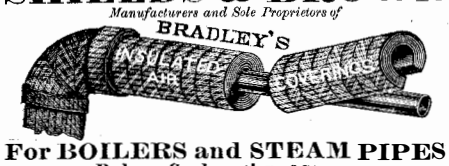

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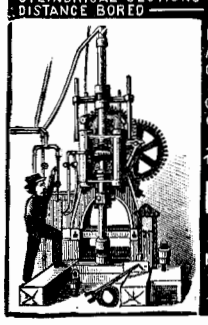
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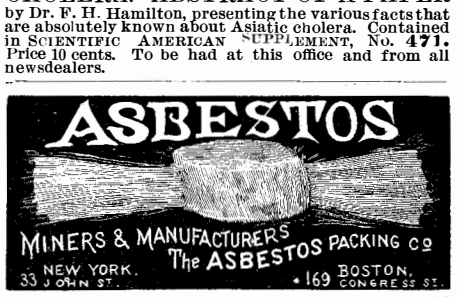

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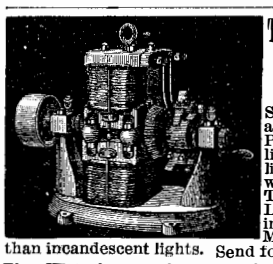
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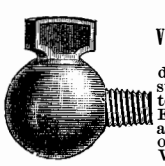
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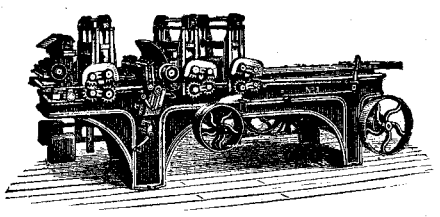

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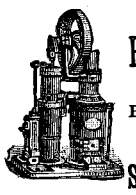

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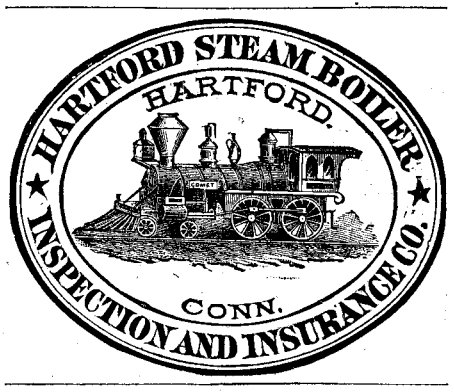

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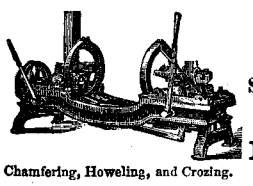

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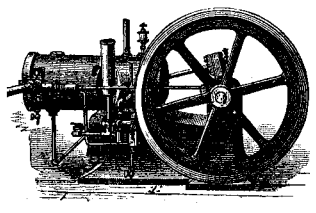

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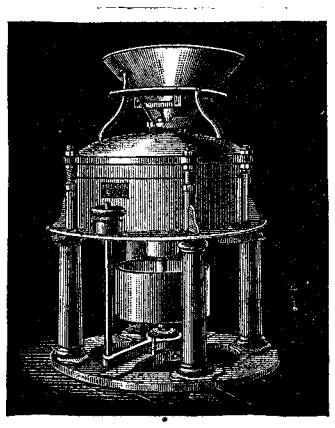

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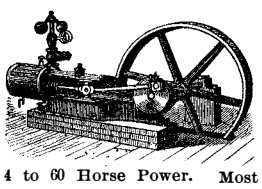

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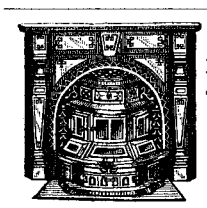
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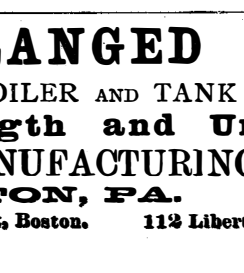

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